Scientific Study of faunal diversity in the purposed mining area & Scat Analysis

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BY

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CERTIFICATE

*This is to certify that the thesis entitled "**Scientific Study of faunal diversity in the purposed mining area & Scat Analysis**" being submitted by Miss Antara roy to National Institute of Technology, Rourkela (Deemed University) for the award of Master's degree in Department of Biotechnology and Medical Engineering with specialization in "**Biotechnology "** is a bonafide research work carried out by her in the **Department of Biotechnology and Medical Engineering**, under my supervision and guidance. I believe that this thesis fulfills the part of the requirement for the award of degree of Master of technology. The research reports and the results embodied in this thesis have not been submitted in parts or full to any other university or institution for the award of any other degree or diploma*

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DECLARATION

The present study titled "**Scientific Study of Faunal Diversity in the purposed mining site and the scat analysis"** is based on my original research work and no part of the thesis has so far been submitted for the award of degree in Master of Technology in Biotechnology or any other degree or diploma to the NIT Rourkela,Orissa, India or elsewhere.

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ABSTRACT

Mining industry proves to be an important support to the economy. Government and mining companies ensures smooth running of the industries and also helps to create strong economy and employment.The nature of mining process has created an unavoidable impact on the environment during the mining operations and even years after the closure of the mines which has posed threats to wildlife. The effect of the significant impact is much higher when mining occurs in remote,isolated, environmentally sensitive areas.Due to the exponential increase in demand for minerals, economics related to the mining sector, the depletion of resources in readily accessible areas, and changing technologies , mining has been increasingly proposed in remote and biodiversity-rich ecosystems that were previously undeveloped for minerals. For this purpose, survey of the mining area to study the fauna diversity was conducted for consecutive four seasons. During the study, indirect sign such as scat was recorded and collected. Scats were then analysed visually in order identify the animal species and their feeding habit. Biochemical tests were also performed in order to get the concentrations of carbohydrate, protein, cholesterol and dry ash content in the scat samples so as to understand dietary composition of each species. Finally, mitigation measures have been suggested for preservation of faunal diversity which is to be implemented during mining activity.

Keywords: Biodiversity, mining , economic growth ,fauna ,scat, mitigation

Contents

List of figures

List of tables

1

INTRODUCTION

1.1 **Introduction**

Biodiversity was first termed by Walter G. Rosen in 1985 [1]. The term biological diversity or biodiversity can have many understandings. It is mostly used to replace one of the previously known and defined terms, species diversity and species richness [2] .'Biological diversity' is that part of the nature which includes the genetic difference among the individuals of a particular species, the richness and variety of all the plant and animal species at different scales, locally, regionally , in the country and around the world, and in various types of ecosystems within a defined area [3].

Biodiversity covers all living organisms and their genetic diversity, a profound and complex range of habitats and ecosystems, and also the processes that corroborate and result from this diversity, such as pollination, photosynthesis, or nutrient cycling [4].In combination with physical and chemical processes, biodiversity largely influences the conditions on Earth. Biodiversity is the degree of change of life-forms within a given species or the entire planet. Biodiversity is also fathoms the health of ecosystems. These include diversity within species, between species and within ecosystems [5]. Biodiversity can be observed mainly at three different levels; the genetic variation within a species, the variety of species within a family, and the organisation of species in an area into distinctive plant and animal communities that makes up the ecosystem diversity [6]. Humans have been able to create thousands of new crop varieties and livestock breeds, with distinct developmental benefits. This has led large increases in the production of food and other natural materials, which has led to the growth and development of human societies [7].

As far as mining is concerned, as per the conventional wiseness, countries that have rich mineral deposits are considered fortunate. Such mineral deposits are assets. In this view of the world, mining is the factor that converts dormant mineral wealth into all other forms of capital that can contribute to the development of the economy [8].

Mining is the extraction of valuable minerals and other geological materials of the earth from an ore body, lode forming a package of economic interest [9]. The nature of mining process creates an unavoidable impact on the environment both during the mining activity and even years after the mines have been closed down. Mining has the ability to affect biodiversity throughout the course of a project, both directly and indirectly. Different mining methods can provide different risks and opportunities for biodiversity. Underground mines typically have a small footprint associated with ore extraction and processing [10].

Direct or primary impacts of mining can be caused from any activity that includes land clearance or direct discharges to water bodies[11].

Indirect or secondary impacts can be led from social or environmental changes induced by mining operations and are often harder to identify immediately. They are long term impacts that are results of waste deposit, sewage, release of harmful gases during active mining process etc [12]. Inspite of the fact that mining activities have significant potential for negative impacts, there is a great effort that companies can put in order to minimize or prevent such impacts in areas that are identified as being appropriate for mining [13]. Companies are capable of implementing biodiversity conservation programs in their operative areas. Being active in the management and assessment of biodiversity is important not only for new ventures but also for those that have been carrying out their operations for couple ofyears, generally under regulative requirements, that were previously less focused on the protection and enhancement of biodiversity [14].With the continual demand for minerals, economics related to the mining sector, the depletion of resources in readily accessible areas, and changing technologies, mining has been increasingly proposed in remote and biodiversity-rich ecosystems that were previously undeveloped and unexplored for minerals [15].

1.2 OBJECTIVES OF THE STUDY

a) Survey of faunal diversity in and around the study area

b) Documentation of animal species available

c) Collection of animal scats from survey area

d) Analysis of the dietary composition of the scats

e) Biochemical Tests of scats

f) Recommendation of suggestive mitigation measures for faunal conservation.

2

LITERATURE REVIEW

2.REVIEW OF LITERATURE

2.1.1 .TYPES OF BIODIVERSITY

a) Genetic diversity

Every individual in a species differs from other individuals in its genetic constitution due to large number of possible combinations of the genes. This genetic variability is veru much important for healthy breeding among the population of a species. The reduction of genetic diversity will result in the in-breeding among species, that may further leads to genetic abnormalities and eventually extinction of that particular species. [16].

b) Species diversity

The number of species of plants and animals present in a particular region comprise its species diversity. This diversity is seen both in agricultural ecosystems and natural ecosystems. Species richness is defined as the number of species in a sample unit or other specified area. At present conservation scientists have been able to identify and categorise about 1.8 million species on earth [17].Every thing in this ecosystem whether it is natural or man-made is made up of a variety of animal and plant species.Ecosystems like tropical rain forests have very high number of species as compared to other ecosystems such as the desert ecosystem [18].

c) Ecosystem diversity

There are a large variety of different ecosystems on the Earth. Discrete ecosystems encompass natural landscapes like forests, grasslands, mountains, deserts etc. And also the aquatic ecosystems like lakes, rivers, sea and ocean. Each of these also has man-modified areas such as farmlands, grazing lands, urban lands etc. The great variety of life on earth has been provided for man's needs over thousands of years. This diversity of living forms a well knit support system which has been used by each civilization for its growth and development [19].

2.1.2 IMPORTANCE OF BIODIVERSITY

The environment is large and much more complex than any man made machinery. The combination of a diversity of life forms and their interactions with each other has made Earth a uniquely habitable place for humans. Biodiversity sustains livelihoods of human beings and life itself. Every human activity has some effect on the natural environment as a whole. The interdependence between people and biodiversity is most apparent for some indigenous peoples who are fully dependent on biodiversity, or whose history, culture and livelihood are closely associated with the natural environment and systems and remains critically important [20].

Humans have been able to create thousands of varities of new crops and livestock breeds, with distinct developmental benefits[21]. This has led to large rise of food and other natural materials production which has led to the growth and development of human societies.Biodiversity is also the foundation of several environmental services that keeps both the mankind and the natural environment alive [22].

These various ecosystem services include:

a) Formation of soil and maintenance of its fertility (nutrient cycling).

b) Elementary production through photosynthesis, as the supportive basis for all life.

c) Provision of food, fibre and fuel.

d) Procurement of shelter and building materials.

e) Regulation and maintenance of water quality.

f) Purification of atmospheric gases.

g) Moderation of climate and weather.

h) Decomposition and detoxification of wastes.

i) Pollination of plants as well as many crops.

j) Controlling of diseases and pests and regulation of genetic resources.

k) Controls and regulation of intra-inter specific interaction between faunal and floral species etc[23].

2.1.3 THREATS TO BIODIVERSITY

Over the last n few decades , population, market demands and the development of novel agricultural technologies have encouraged different patterns of agricultural development tending towards natural resources degradation . Biodiversity losses are incurred due to the resource demands of our rapidly multiplying human population. Like other living beings, natural resources are used by humans in order to survive, but they are way more destructive and resourceful to other life-forms than any species previously known. As the world's population increases, there is a gradual decrease in remaining natural habitat as the land is being developed for human habitation and activities [24].All the organisms on Earth (including human) must share the same limited resources (food, water, space) for their possible existence in this world. Threat to biodiversity systems mainly consists habitat disintegration , degradation and loss; shrinkage of genetic diversity; climatic change and desertification; over exploitation of resources; impact of developmental projects.[25].

2.1.4 IMPACT OF MINING ON BIODIVERSITY

The impact of mining can be broadly classified as direct impact and indirect impact.

I. Direct impact

Direct or primary impacts from mining can result from any activity that involves land clearance (such as tailings impoundment construction , accessable road construction) or direct discharges to water bodies (riverine tailings disposal or the air (such as dusts or smelter emissions)[26] . Surface water pollution can be cuased due to waste water discharges, related heavy metal ,sewage disposal, mining dumps , which may affect aquatic diversity or contaminate drinking water sources for wildlife [27]. Direct impacts are usually readily identifiable.

II. Indirect impact

Indirect or secondary impacts can result from social or environmental changes induced by mining operations and are often harder to identify immediately. They are long term impacts that are results of waste deposit, sewage, release of harmful gases during active mining process etc. Cumulative impacts occur where mining projects are developed in environments that are influenced by other projects, both mining and non-mining. Indirect impact may also led to loss of cultural, tradition and language as large

section of the community are rehab to other areas from their traditional villages and communities (IFC, 2013).The effect for negative impacts is greater when mining takes place in remote, inaccessible, environmentally sensitive areas.Due to the exponential increase in demand for minerals, economics related to the mining sector, the depletion of resources in readily accessible areas, and changing technologies , mining has been increasingly proposed in remote and biodiversity-rich ecosystems that were previously undeveloped and unexplored for minerals [28].

2.1.5 FAUNA SURVEY TECHNIQUE

The first stage of the assessment will contain an identified list of significant species that may occur in the area and the gaps in the information that are prerequisite to meet the objectives. The sole purpose of the field survey is to methodically survey the area of interest using standardized methods that will deal with the identified gaps [29].

There are 2 types of fauna survey approach:

a) Generic fauna survey involving methods that can collectively be used to provide a tad-complete list of terrestrial vertebrate fauna species such as amphibian reptiles, diurnal bids, nocturnal birds ,terrestrial mammals, arboreal and Volant mammals, medium- large terrestrial mammal mammals [30].

b) Targeted fauna survey primarily focusses on specific significant species that are pretty much unlikely to be recorded by generic surveys due to localised habitat requirements or cryptic behaviour. These surveys are based on ecological habitat requirements and behavioural traits of the species of interest [31].

Survey area is the area which contains all of the assessment units, i,e generic and target survey area .General physical property of the survey area such as climate,geology ,soild and vegetation needs to be known. The fundamental step in fauna survey design and the proper selection of generic survey sites is the stratification of the study area I,e portioning of an area into assessment units that has a comparative homogeneous environment which are then used for the determination of the location and number of sites required for proper assessment of the survey area [32].

2.1.6 SAMPLING TECHNIQUES:

Sample survey data is used regarding the population of interest in wildlife studies in order to make predictions. Simple random sample is the most basic method for sample selection but other methods are also relevant including stratified random sampling, systematic sampling, sequential random sampling ,cluster sampling, adaptive sampling etc [33].

a) Haphazard sampling: The sampling methods is appropriate when the targeted population is homogeneous. It involves taking samples at convenient locations leading to biased estimates of population characteristics

b) Judgement sampling: Subjective selection of population units by an individual .Subjective sampling can be accurate but the extent of accuracy is difficult to quantify.

c) Search sampling: require pre-existing knowledge of the resources of interest .Hot spot searching during the investigation of environmental pollution is a form of search sampling.Value of the data obtained from this procedure depends on the information accuracy of time and location of search [34].

d) Probability sampling: Sample selection from a group of sample units each with known probability of being chosen.

e) Simple random sampling obtained by following the basic steps in the following list:

i. The population of sampling units can be assumed to be finite.

ii. Measurement of the attribute of unit is possible.

iii. Study region or study period is known as sampling frame must be distinct.

iv. Sampling frame must be a non overlapping unit.

v. Sample units are normally sampled without replacement.

vi. No need of sampling units to be of equal size or to be selected with equal probability.

f) Stratified sampling: Sampling effort to be increase to be expanded over strata of the study area. Units within the strata selected for study. These units may also be subdivided or stratified for subsampling. Strata should be homogeneous in terms of animal density .The study area might be stratified into regions of high .medium and low forest cover by the wildlife biologist. [35].

g) Systematic sampling: This method can be used when a population takes up a well defined spatial region. A sample uses a systematic array of points. Systematic sampling encompasses distribution of location of samples uniformly over the area .First point in a systematic sample is chosen randomly and rest of the points are situated in reference to the chosen random point.

3

MATERIALS AND METHODS

3.1 MATERIALS AND METHODS

3.1.1 THE PROPOSED STUDY AREA

The Sarkunda Iron and Manganese Mines of M/S Feegrade and company limited belongs the Sri Ram Rungta group of mines pvt limited situated in Koira of Keonjhar district of Odisha, India. Lease mining area consist of three villages and some partition of reserve forest as listed below

Table 3. 1 LOCATION OF THE LEASE AREA

S.No.	NAME OF THE VILLAGES	LATITUDE	LONGITUDE	AREA IN ACRES
1	Bhatula	21deg49’12.86’’	85deg09’08.38”	505.21
2	Ronda	21deg49’22.06”	85deg08’11.09”	145.39
3	Damula	21deg49’04.08”	85deg09’08.38”	5.50
4	Reserve forest	21deg49’23.06”	85deg07’24.04”	316.40

The lease area is surrounded by two other mines namely AMTC and SAIL. The lease area covers a total area of 972.50 acres or 393.50hec of which 390 hectare comes under the forest land of sarkunda mines and 3.56 is non forest land.

a) Topography

Core Zone- The project area is almost plain with gentle undulation. Mainly sloping towards the north. Several water bodies also exist in the study area.

Buffer Zone: An area 10KM around the periphery of the core zone. In the study area, the ground elevation varies approximately 500m-900m above mean sea level.

b) Climate

The climate of the area is immensely hot during summer and moderately cold during winters. The average annual rainfall recorded is 1469.0mm.Average maximum and minimum temperature recorded to be 36.8°C in May and 11.14°C in December. Average minimum humidity is found to be 30% and average maximum humidity is 80.5%.

c) Ecology

The nature of the soil in that area is lateritic and brownish and reddish in colour. The soil texture is loamy and has moderate fertility . Soil contains organic carbon , potassium and sulphur. Forests within the revenue village account for 34.55% of the study area .The forest are Sal dominated Northern tropical moist deciduous type.

d) Water quality

Ground water occurs from the braved out portions of hard rocks as well as in the loose and stratified alluvial sediments.4 streams of water have been observed in that study area which has therefore divided into various sub streams .Surface water analysis shows turbidity and iron exceeds the permissible limit in all most all water samples whereas in some cases, lead crosses the permissible limit.

Fig 3. 2 Coordinates of the lease mining area

Fig 3. 1 Trajectory of the survey conducted

Fig 3. 3 During the field survey

3.1.2 SURVEY TECHNIQUES

A. Direct observations

i. Active diurnal and passive nocturnal searches-Active searches primarily focuses on recording the presence of reptiles and amphibians but also detects small terrestrial mammals and signs of cryptic species. It involves scanning for active animals as well as looking under barks, crevices and other microhabitat, raking through leaf filter .Other secondary signs can also be recorded.

ii. Nocturnal searches-These were carried out in order to detect those animals which are active mainly during the night. Nocturnal searches are predominantly observational with non invasive techniques and involves searching for active reptiles, looking for eye shine and hearing for activity.

iii. Camera traps- Non invasive survey techniques designed to detect medium to large sized animals as they pass. It employs digital camera that are triggered by a passive infrared motion sensor. With high resolution cameras, white flashes, experienced observers, some small and specific species can be identified.

iv. Transect method-Extensive field surveys was carried out in the study area and then line transects were laid in different parts to collected information on animal signs based on direct sightings and indirect evidences (tracks, scats, claw marks, nests and others.

The starting points of transects were chosen randomly in different forest types within a range. Each line transect was walked by a team of 4-5 people. One person walked along the midline, measured the length of transect with a measuring rope, and recorded the information. Two to three people searched for animal signs along five meter strips on either side of the mid-line, and recorded the data. To avoid any basis the team members held the same role for all transects although, they alternated on sides of the midline. Field equipment comprised of a compass, map and GPS unit (Garmin) were used for navigation and 10 meter and 5 meter lengths of rope for measuring the widths and length of transects.

B. Indirect signs

i. Secondary signs of animals provide the proof of occurrence of the activity of a species at a site and include tracks, scratches,feeding marks, scats, hair,feathers and bones

ii. Tracks-Tracks in the form of foot prints or drag marks left in soft substrate such as mud or sand was obtained .Footprints are useful way to determine whether a species is present at or within the survey site.

iii. Scats-scats are the most evident and most easily recognizable signs. However rarity of some species difficult the observation as well as other factors likes presence of faeces or the behaviour of defecating inside the water or on the branches of trees. Scats are usually of a characteristic size and shape which enables animal identification at a species level .

iv. Scratches-Large and arboreal mammals leave their scratch marks on the smooth barked tree while climbing up using their claws. Scratch marks made by bear are distinctive.

v. Hair, feathers, bones, nest, carcasses-These are often unique and distinctive resulting in identification of species. Shed skin of reptiles are analysed for scale counts and distinctive features. This type of secondary signs indicate the presence of a species within the survey area not necessarily at the generic site as the remains could have transferred from the site to elsewhere by other animals.

3.1.3 DISTINCT TECHNIQUE FOR DISTINCTIVE SPECIES

a) Mammals

The mammal survey was carried out by walking through different forest habitats, recording and collecting evidence of mammals. Besides fixed transect survey, random search was also adopted to record the occurrence mammalian species in the study area. Indirect evidences such as scats, pug foot marks and calls of different mammalian species were also collected during the study.

b) Birds:

Surveyed for birds was done from different representative areas like wetlands, different forest types and grasslands. Observations were made entire day. However, time schedule was altered according to situation and availability of time.

c) **Reptiles**:

The survey was mostly restricted to the road and accessible areas in its vicinity. A portion of the time was spent inside the forest on shortcuts and footpaths. Water bodies and roadside water channels especially for amphibians were looked for any sign for them. Search was usually done in the morning, another around dusk. Active reptiles (moving about or basking in the sun) as well as for those resting or hiding beneath rocks, logs, bark, leaf litter, culverts etc were also looked during the survey.

d) Butterflies:

They play an important role in pollination were also surveyed. Butterflies were observed during the morning, when the butterflies are most active. Pollard walk method (Pollard 1977) was used for identification of butterflies, i.e., walking along the fixed paths or transects while recording and counting the species. Identification and classification of butterflies was done following Kunte (2000) and as per Kehimkar(2008). Unfamiliar species were photographed for identification in later stage. Species observed outside the transect lines and forest edges were noted separately.

3.1.4 QUESTIONNAIRE SURVEY

Information was gathered by verbal communication with the people of Rondavillage of Sarkunda Iron and Mangenese mines during the survey.

3.1.4 SAMPLE COLLECTION

i. Area was exhaustively searched for scats
ii. Scat samples were collected throughout the study area during various seasons.
iii. Fresh Scat were collected, sundried and stored individually in freezer bags.
iv. Each scat was labelled with location, comments on the condition and date of collection.
v. Those scat samples were weighed.

3.1.5 Visual analysis of dietary composition of scats

i. Scats were collected and sundried individually.
ii. Scats were then collected in 100ml water in small beaker.
iii. These were then passed through a series of sieves (2.0,1.0 and 0.5mm mesh) to clean the mud and debris.
iv. Samples were dried for 24 hr in an oven for 40^{o}C.
v. Filtrate were collected in different flasks.
vi. Cleaned scats were placed in a petri dish and analysed visually.

3.1.6 Biochemical tests of scat samples

i. For Carbohydrates

- Qualitative test (Molisch test)-The aim of the test is to detect the presence of carbohydrate in the sample. The test reagent upon mixing with 1 ml of concentrated sulphuric acid dehydrates to form furfural and dehydrates hexoses to form 5-hydroxy methyl furfural. The furfurals then react with 2 drops of α-naphthol to produce a purple product. The coloured product indicates a positive result.

- Quantitative test (Anthrone Test)-To determine the total carbohydrate present in the scat sample, 200mg of anthrone was dissolved in 100ml of ice cold 95% sulphuric acid. Standards along with the test sample were prepared. 4ml of the anthrone reagent was added. The test reagents were heated and the rapidly cooled and green to dark green colour was read at 630 nm. In hot acidic medium, glucose is dehydrated to hydroxymethyl furfural.

The compound formed with anthrone is a green coloured product with an absorption maximum at 630 mn.

- Standard graph was prepared having a slope =0.0592 and the based on the standard graph conc of carbohydrate / scat sample was calculated

ii. For proteins

- Qualitative estimation of protein of scat sample by a colorimetric potein assay which based on an absorbance shift of the dye Coomassie Brilliant Blue G-250 in which uner acidic conditions the red form of the dye is converted into the bluer form to bind to the protein being assayed.

- Quantitative estimation of Protein-Determination of microgram quantities in the Bradford assay is accomplished by measurement of absorbance at 595nm.The most common assay enables rapid and simple protein quantification in cell lysates, cellular fractions or recombinant protein samples. Standards and test samples were prepared.1ml of Bradford was added to the samples and was left for incubation in the dark for 20 mins. The change in colour and the absorbance was observed.

- Standard graph was prepared having a slope =0.02 and the based on the standard graph conc of protein / scat sample was calculated

iii. For cholesterol

- Qualitative test in order to determine the presence of cholesterol in the sample. The Libermann Buchard reaction for sterols which consists of adding a few drops of acetic anhydride and concentrated sulphuric acid to the choloroform solution .Green coloration is formed due to sulphonic acid derivative of cholesterilene.

- Quantitative test for cholesterol to determine the total cholesterol present in the scat sample by Libermann Buchard test. Standards and test samples were prepared .2ml of cholorofom was added, followed by that,10 drops of acetic anhydride were added and the finally 2 drops concentrated sulphuric acid was added and mixed well. Absorbance was measured at 788 nm.

- Standard graph was prepared having a slope =0.00108 and the based on the standard graph conc of cholesterol / scat sample was calculated

iv. For the estimation of the proportion of ash

- The total inorganic residue remaining after the water and organic matter have been removed gives the meaure of the total amount of minerals within a food..5g of the sample was put in crucibles and then those crucibles are then put in the furnace and burned at 550^{o}C for 5 hours.

- Total % of dry ash obtained =((D1-D2)÷D1)×100

3.1.7 Analysis of variance

Anova was done for Sloth bear Scat samples in order to get the statistical significance of seasonal change in the dietary composition.

4

RESULTS AND DISCUSSIONS

4.1 RESULTS AND DISCUSSIONS

4.1.1 Faunal diversity for phase I summer season

Faunal species recorded in the core zone during the survey:-

7 species of mammals belonging to 7 different families,5 species of birds of 5 families,12 species of butterflies Nymphalidae family and 9 species of butterflies from rest 3 different families,3 species of reptiles from 3 different family.

Faunal species recorded in the buffer zone during the survey:-

5 species of mammals from 5 different families and 2 species from 1 family,4 species of birds belonging to 4 different families,28 species of butterflies from 4 different families,4 species of reptiles from 4 different families.

Table 4. 1 List of mammals in the Core zone

Sl no.	Family name	Common name	Scientific name	IWPA,1972
1	Suidae	Wild Boar	Sus scrofa	III
2	Cervidae	Barking Dear	Muntiacus muntjak	III
3	Felidae	Wild cat	Felis chaus	II
4	Erethizontidae	Porcupine	Hystrix indica	IV
5	Hyaenidae	Hyena	Hyaena hyaena	III
6	Ursidae	Sloth Bear	Melursus ursinus	I
7	Bovidae	Wild buffalo	Bubalus bubalis	I

Table 4. 2 List of mammals in the buffer zone

Sl no.	Family name	Common name	Scientific name	IWPA,1972
1	Suidae	Wild pig	Sus scrofa	III
2	Cervidae	Barking Dear	Muntiacus muntjak	III
3	Felidae	Leopard	Panthara pandus	I
4	Felidae	Wild cat	Felis chaus	II
5	Herpestidae	Mangoose	Herpestidae	Least concern
6	Elephantidae	Elephant	Elephas maximus	1
7	Cercopithecidae	Monkey	Macaca mulatta	Least concern

Table 4. 3 List of birds in the core zone

Sl no.	**Family Name**	**Common name**	**Scientific name**	**Threat as per IUCN**
1	Caprimulgidae	House Crow	*Corvus splendens*	Least Concern
2	Corvidae	Large-Billed Crow/Jungle Crow	*Corvus macrorhynchos*	Least Concern
3	Upupidae	Common Hoopoe	*Upupa epops*	Least Concern
4	Meropidae	Green Bee-Eater	*Merops orientalis*	Least Concern
5	Accipitridae	Indian Black Eagle	*Ictinaetus malayensis*	Least Concern

Table 4.4 List of birds in the buffer zone

Sl no.	**Family Name**	**Common name**	**Scientific name**	**Threat as per IUCN**

1	*Milvus migrans*		Common kite	
2	*Egretta garzetta*	Ardeidae	Little Egret	Least Concern
3	*Mesophoyx intermedia*	Ardeidae	Median Egret	Least Concern
4	*Bubulcus ibis*	Ardeidae	Cattle Egret	Least Concern
5	*Ardeola grayii*	Ardeidae	Indian Pond-Heron	Least Concern
6	*Psittacula columboides*		Parrot	
7	*Elanus caeruleus*	Accipitridae	Black-shouldered Kite	Least Concern
8	*Milvus migrans*	Accipitridae	Black Kite	Least Concern
9	*Spilornis*	Accipitridae	Crested Serpent Eagle	Least Concern
10	*Accipiter badius dussumieri*	Accipitridae	Indian shikra	
11	*Gallus gallus*	Phasianidae	Red Jungle fowl	Least Concern
12	*Streptopelia decaocto*		Dove	
13	*Vanellus indicus*	Charadriidae	Red-wattled Lapwing	Least Concern
14	*Columba livia*	Columbidae	Blue Rock Pigeon	Least Concern
15	*Streptopelia chinensis*	Columbidae	Spotted Dove	Least Concern
16	*Psittacula eupatria*	Psittacidae	Alexandrine Parakeet	Least Concern
17	*Cuculus canorus*	Cuculidae	Common Cuckoo	Least Concern
18	*Eudynamys scolopacea*	Cuculidae	Asian Koel	Least Concern
19	*Cypis bengalensis*		Vulture	Least concern
20	*Caprimulgus asiaticus*	Caprimulgidae	Common Indian Nightjar	Least Concern
21	*Megalaima haemacephala*	Capitonidae	Coppersmith Barbet	Least Concern
22	*Coracina macei*	Campephagidae	Large Cuckoo-Shrike	Least Concern
23	*Coracina melanoptera*	Campephagidae	Black-headed Cuckoo-Shrike	Least Concern
24	*Pericrocotus flammeus*	Campephagidae	Scarlet Minivet	Least Concern
25	*Tephrodornis pondicerianus*	Campephagidae	Common Woodshrike	Least Concern
26	*Pycnonotus jocosus*	Pycnonotidae	Red-whiskered Bulbul	Least Concern
27	*Pycnonotus cafer*	Pycnonotidae	Red-vented Bulbul	Least Concern
28	*Aegithina tiphia*	Irenidae	Common Iora	Least Concern

29	*Copsychus saularis*	Turdinae	Oriental Magpie-Robin	Least Concern
30	*Copsychus malabaricus*	Turdinae	White-rumped Shama	Least Concern
31	*Saxicoloides fulicata*	Turdinae	Indian Robin	Least Concern
32	*Nectarinia zeylanica*	Nectariniidae	Purple rumped sunbird	Least Concern
33	*Zosterops palpebrosus*	Zosteropidae	Oriental White-eye	Least Concern
34	*Lonchura punctulata*	Estrildidae	Spotted Munia	Least Concern

Table 4. 4 List of butterflies in core zone

Sl.no	Family Name	Common Name	Scientific Name	(IWPA,1972)
1	Papilionidae	Lime Buttrefly	Papilio demoleus	NA
2		Common Mormon	Papiliopolytes	NA
3		Common Bluebottle	Graphium sarpedon	NA
4		Common Mime	Chilasa mime	NA
5	Pieridae	Indian Cabbage White	Pieris canida	NA
6		Red-Base Jezebel	Delias pasithoe	NA
7		Common Jezebel	Delias eucharis	NA
8	Lycaenidae	Large Oak Blue	Arhopala amantes	NA
9		Plum Judy	Abisaran echerius	NA
10		Common Nawab	Polyura anthamas	NA
11		Great Evening Brown	Melanitis zitenius	NA
12		Common Sailer	Neptis hylas	NA
13		Gaudy Baron	Euthalia lubentina	NA
14		Striped Tiger	Danaus genutia	NA
15		Glassy Tiger	Parantica aglea	NA

16	Nymphalidae	Plain Tiger	Danaus chrysippus	NA
17		Common Crow	Euploea core	NA
18		Common Evening Brown	Melanitis leda	NA
19		Grey Pansy	Junonia atlites	NA
20		Peacock Pansy	Junonia almana	NA
21		Blue Pansy	Junonia oritya	NA

Table 4. 5 List of butterflies in the buffer zone:

Sl.no	Family Name	Common Name	Scientific Name	(IWPA,1972)
1	Papilionidae	Lime Buttrefly	Papilio demoleus	NA
2		Common Mormon	Papiliopolytes	NA
3		Common Bluebottle	Graphium sarpedon	NA
4		Common Mime	Chilasa mime	NA
5	Pieridae	Indian Cabbage White	Pieris canida	NA
6		Red-Base Jezebel	Delias pasithoe	NA
7		Common Jezebel	Delias eucharis	NA
8	Lycaenidae	Large Oak Blue	Arhopala amantes	NA
9		Plum Judy	Abisaran echerius	NA
10	Nymphalidae	Common Nawab	Polyura anthamas	NA
11		Great Evening Brown	Melanitis zitenius	NA
12		Common Sailer	Neptis hylas	NA
13		Gaudy Baron	Euthalia lubentina	NA
14		Striped Tiger	Danaus genutia	NA
15		Glassy Tiger	Parantica aglea	NA
16		Plain Tiger	Danaus chrysippus	NA

17		Chestnut Tiger	Parantica sita	NA
18		Common Crow	Euploea core	NA
19		Common Evening Brown	Melanitis leda	NA
20		Common Four-Ring	Ypthima huebneri	NA
21		Indian Red Admiral	Vanessa indica	NA
22		Grey Pansy	Junonia atlites	NA
23		Peacock Pansy	Junonia almana	NA
24		Blue Pansy	Junonia oritya	NA
25		Great Egg Fly	Hypolimnas bolina	NA
26		Common Castor	Ariadne merione	NA

Table 4. 6 List of reptiles in buffer zone

Sl.no	Family Name	Common Name	Scientific Name	(IWPA,1972)
1	Scincidae	Indian Forest Skink	Sphenomorphus indicus	NA
2	Agamidae	Indian Garden Lizard	Calotes versicolor	NA
3	Elapinae	Indian Cobra	Naja naja	NA

Table 4. 7 List of reptiles in core zone

Sl.no	Family Name	Common Name	Scientific Name	(IWPA,1972)
1	Scincidae	Indian Forest Skink	Sphenomorphus indicus	NA
2	Agamidae	Indian Garden Lizard	Calotes versicolor	NA
3	Elapinae	Indian Cobra	Naja naja	NA
4	Varanidae	Monitor lizard	*Varanus monitor*	IV

Table 4. 8 List of amphibians in core zone

Sl.No.	Family	Scientific Name	Common Names	Threat as per IUCN
1	Bufonidae	*Duttaphrynus melanostictus*	Common Asian Toad	Least Concern
2	Racophoridae	*Polypedates maculatus*	Common Indian Treefrog	Least Concern

Table 4. 9 List of amphibians in buffer zone

Sl.no	Scientific Nam	Family	Common Names	Threat as per IUCN
1.	*Hoplobatrachus tigerinus*	Dicroglossidae	Indian Bull Frog	Least Concern

Fig 4. 1 Banded krait

Gps coordinates: N 21°49’19.2” E 85°9’23

Fig 4. 2 jackal foot print

Gps coordinates: N 21°49’27.3” E 85°54’50”

Fig 4. 3 hyena footprint

Gps coordinates:N 21°49’17” E 85°57’34”

Fig 4. 4 Peacock Egg shell

Gps coordinates:N 21°47’09” E 85°11’62”

4.1.2 Faunal diversity for phase II (rainy season)

The starting points of transects was chosen randomly in different forest types within a range. From transect survey, 12 species of mammals belonging to 11 different families, 42 species of birds of 27 families, 23 species of butterflies from 4 different families, 15 species of reptiles from 5 different family recorded in the core zone and 16 species of mammals from 13 different families, 25 species of birds belonging to 16 different families, 28 species of butterflies from 3 different families, 15 species of reptiles from 4 different families recorded in the buffer zone were documented.

Table 4. 10 List of mammals in core zone.

Sl.no.	Scientific Name	Family	Common Name	Type of Observations Sighting or Evidences	Indian Wildlife Protection Act (IWPA)**
1.	*Macaca mulatta*	Cercopithecidae	Rhesus Macaque	Sighting	SchII

2.	*Muntiacus muntjak*	Cervidae	Barking Deer	Sighting	SchIII
3.	*Sus scrofa*	Suidae	Wild Pig	Evidences (Feeding sign)	SchIII
4.	*Melursus ursinus*	Ursidae	Sloth Bear	Evidences (Scat)	Sch I
5.	*Canis aureus*	Canidae	Jackal	Evidences (Scat)	SchII
6.	*Canis lupus*	Canidae	Indian Wolf	Evidences (Scat)	SchII
7.	*Felis chaus*	Felidae	Jungle Cat	Evidences (Scat)	SchII
8.	*Lepus nigricollis*	Leporidae	Indian Hare	Evidences (Pellet)	SchIII
9.	*Suncus murinus*	Soricidae	House Shrew		SchIV
10.	*Hystrix indica*	Hystricidae	Indian Porcupine	Evidences (Pellet)	SchIV
11.	*Funambulus palmarum*	Sciuridae	Three-striped Palm Squirrel	Sighting	Least Concern
12.	*Bandicota bengalensis*	Muridae	Lesser Bandicoot-rat	Burrow	Least Concern

Table 4. 11 List of mammals in buffer zone:

Sl.no.	**Scientific Name**	**Family**	**Common Name**	**Type of Observations Sighting or Evidences**	**Indian Wildlife Protection Act (IWPA)****
1	*Macaca mulatta*	Cercopithecidae	Rhesus Macaque	Sighting	SchII
2	*Muntiacus muntjak*	Cervidae	Barking Deer	Sighting	SchIII
3	*Sus scrofa*	Suidae	Wild Pig	Evidences (Feeding sign)	SchIII
4	*Elephas maximus*	Elephantidae	Asian Elephant	Evidences	Sch I

				(Foot marks)	
5	*Melursus ursinus*	Ursidae	Sloth Bear	Evidences (Scat)	Sch I
6	*Canis aureus*	Canidae	Jackal	Evidences (Scat)	SchII
7	*Canis lupus*	Canidae	Indian Wolf	Evidences (Scat)	SchII
8	*Felis chaus*	Felidae	Jungle Cat	Evidences (Scat)	SchII
9	*Lepus nigricollis*	Leporidae	Indian Hare	Evidences (Pellet)	SchIII
10	*Suncus murinus*	Soricidae	House Shrew		SchIV
11	*Hystrix indica*	Hystricidae	Indian Porcupine	Evidences (Pellet)	SchIV
12	*Funambulus palmarum*	Sciuridae	Three-striped Palm Squirrel	Sighting	Least Concern
13.	*Bandicota bengalensis*	Muridae	Lesser Bandicoot-rat	Burrow	Least Concern
14.	*Rattus rattus*	Muridae	House Rat	Scat	Least Concern
15.	*Pipistrellus coromandra*	Vespertilionidae	Indian Pipistrelle	Sighting	Least Concern
16.	*Pipistrellus tenuis*	Vespertilionidae	Least Pipistrelle	Sighting	Least Concern

Table 4. 12 List of birds in core zone

Sl. No.	**Family**	**Scientific Name**	**Common Name**	**Threat as per IUCN**
1	Accipitridae	*Elanus caeruleus*	Black-shouldered Kite	Least Concern
2	Accipitridae	*Accipiter badius dussumieri*	Indian shikra	
3	Phasianidae	*Gallus gallus*	Red Junglefowl	Least Concern
4	Columbidae	*Columba livia*	Blue Rock Pigeon	Least Concern
5	Columbidae	*Streptopelia chinensis*	Spotted Dove	Least Concern

6	Psittacidae	*Psittacula krameri*	Rose-ringed Parakeet	Least Concern
7	Cuculidae	*Cuculus canorus*	Common Cuckoo	Least Concern
8	Cuculidae	*Eudynamys scolopacea*	Asian Koel	Least Concern
9	Strigidae	*Athene brama*	Spotted Owlet	Least Concern
10	Caprimulgidae	*Caprimulgus asiaticus*	Common Indian Nightjar	Least Concern
11	Caprimulgidae	*Caprimulgus indicus*	Indian Jungle Nightjar	Least Concern
12	Apodidae	*Cypsiurus balasiensis*	Asian Palm-Swift	Least Concern
13	Apodidae	*Apus affinis*	House Swift	Least Concern
14	Meropidae	*Merops orientalis*	Small Bee-eater	Least Concern
15	Coraciidae	*Coracias benghalensis*	Indian Roller	Least Concern
16	Capitonidae	*Megalaima zeylanica*	Brown-headed Barbet	Least Concern
17	Capitonidae	*Megalaima haemacephala*	Coppersmith Barbet	Least Concern
18	Motacillidae	*Anthus rufulus*	Paddyfield Pipit	Least Concern
19	Campephagidae	*Coracina macei*	Large Cuckoo-Shrike	Least Concern
20	Campephagidae	*Pericrocotus flammeus*	Scarlet Minivet	Least Concern
21	Pycnonotidae	*Pycnonotus jocosus*	Red-whiskered Bulbul	Least Concern
22	Pycnonotidae	*Pycnonotus cafer*	Red-vented Bulbul	Least Concern
23	Turdinae	*Copsychus saularis*	Oriental Magpie-Robin	Least Concern

24	Turdinae	*Copsychus malabaricus*	White-rumped Shama	Least Concern
25	Turdinae	*Saxicoloides fulicata*	Indian Robin	Least Concern
26	Timaliinae	*Turdoides caudatus*	Common Babbler	Least Concern
27	Timaliinae	*Turdoides striatus*	Jungle Babbler	Least Concern
28	Sylviinae	*Prinia sylvatica*	Jungle Prinia	Least Concern
29	Sylviinae	*Orthotomus sutorius*	Common Tailorbird	Least Concern
30	Dicaeidae	*Dicaeum agile*	Thick-billed Flowerpecker	Least Concern
31	Nectariniidae	*Nectarinia asiatica*	Purple Sunbird	Least Concern
32	Nectariniidae	*Nectarinia zeylanica*	Purple rumped sunbird	Least Concern
33	Zosteropidae	*Zosterops palpebrosus*	Oriental White-eye	Least Concern
34	Estrildidae	*Lonchura punctulata*	Spotted Munia	Least Concern
35	Passerinae	*Passer domesticus*	House Sparrow	Least Concern
36	Sturnidae	*Sturnus contra*	Asian Pied Starling	Least Concern
37	Phasiandae	*Pavo cristatus*	Peafowl	
38	Sturnidae	*Acridotheres tristis*	Common Myna	Least Concern
39	Oriolidae	*Oriolus xanthornus*	Black-headed Oriole	Least Concern
40	Dicruridae	*Dicrurus macrocercus*	Black Drongo	Least Concern

41	Corvidae	*Dendrocitta vagabunda*	Indian Treepie	Least Concern
42	Corvidae	*Corvus splendens*	House Crow	Least Concern

Table 4. 13 List of birds in the buffer zone

Sl.no	Family name	Common name	Scientific name	Threats as per iucn
1	Motacillidae	*Anthus rufulus*	Paddyfield Pipit	Least Concern
2	Campephagidae	*Coracina macei*	Large Cuckoo-Shrike	Least Concern
3	Campephagidae	*Pericrocotus flammeus*	Scarlet Minivet	Least Concern
4	Pycnonotidae	*Pycnonotus jocosus*	Red-whiskered Bulbul	Least Concern
5	Pycnonotidae	*Pycnonotus cafer*	Red-vented Bulbul	Least Concern
6	Turdinae	*Copsychus saularis*	Oriental Magpie-Robin	Least Concern
7	Turdinae	*Copsychus malabaricus*	White-rumped Shama	Least Concern
8	Turdinae	*Saxicoloides fulicata*	Indian Robin	Least Concern
9	Timaliinae	*Turdoides caudatus*	Common Babbler	Least Concern
10	Timaliinae	*Turdoides striatus*	Jungle Babbler	Least Concern

11	Sylviinae	*Prinia sylvatica*	Jungle Prinia	Least Concern
12	Sylviinae	*Orthotomus sutorius*	Common Tailorbird	Least Concern
13	Dicaeidae	*Dicaeum agile*	Thick-billed Flowerpecker	Least Concern
14	Nectariniidae	*Nectarinia asiatica*	Purple Sunbird	Least Concern
15	Nectariniidae	*Nectarinia zeylanica*	Purple rumped sunbird	Least Concern
16	Zosteropidae	*Zosterops palpebrosus*	Oriental White-eye	Least Concern
17	Estrildidae	*Lonchura punctulata*	Spotted Munia	Least Concern
18	Passerinae	*Passer domesticus*	House Sparrow	Least Concern
19	Sturnidae	*Sturnus contra*	Asian Pied Starling	Least Concern
20	Phasiandae	*Pavo cristatus*	Peafowl	
21	Sturnidae	*Acridotheres tristis*	Common Myna	Least Concern
22	Oriolidae	*Oriolus xanthornus*	Black-headed Oriole	Least Concern
23	Dicruridae	*Dicrurus macrocercus*	Black Drongo	Least Concern

24	Corvidae	*Dendrocitta vagabunda*	Indian Treepie	Least Concern
25	Corvidae	*Corvus splendens*	House Crow	Least Concern

Table 4. 14 List of butterflies in core zone

Sl. No.	Scientific Name	Family	Common Name	Threat as per IUCN
1.	*Sarangesa dasahara*	Hesperiidae	Common Small Flat	NA
2.	*Tagiades gana*	Hesperiidae	Suffused Snow Flat	NA
3.	*Spialiagalba*	Hesperiidae	Indian Skipper	NA
4.	*Oriens goloides*	Hesperiidae	Common Dartlet	NA
5.	*Borbo cinnara*	Hesperiidae	Rice Swift	NA
6.	*Matapa aria*	Hesperiidae	Common Redeye	NA
7.	*Graphium doson*	Papilionidae	Common Jay	NA
8.	*Papilio demoleus*	Papilionidae	Lime Butterfly	NA
9.	*Papilio polyctor Boisduval*	Papilionidae	Common Peacock	NA
10.	*Atrophaneura aristolochiae*	Papilionidae	Common Rose	NA
11.	*Atrophaneura hector*	Papilionidae	Crimson Rose	NA
12.	*Eurema blanda*	Pieridae	Three Spot Grass Yellow	NA
13.	*Eurema hecabe*	Pieridae	Common Grass Yellow	NA
14.	*Catopsilia Pomona*	Pieridae	Common Emigrant	NA
15.	*Pareronia valeria*	Pieridae	Common Wanderer	NA
16.	*Arhopala atrax*	Lycaenidae	Indian Oakblue	NA
17.	*Loxura atymnus*	Lycaenidae	Yam Fly	NA
18.	*Spindasis vuanus*	Lycaenidae	Common Silverline	NA
19.	*Pseudozizeeria maha*	Lycaenidae	Pale Grass Blue	NA
20.	*Freyeria trochylus*	Lycaenidae	Grass Jewel	NA
21.	*Zizinaotis*	Lycaenidae	Lesser Grass Blue	NA
22.	*Zizula hylax*	Lycaenidae	Tiny Grass Blue	NA

23.	*Euchrysops cnejus*	Lycaenidae	Gram Blue	NA

Table 4. 15 List of butterflies in buffer zone

Sl. No.	Scientific Name	Family	Common Name	Threat as per IUCN
1	*Eurema hecabe*	Pieridae	Common Grass Yellow	NA
2	*Catopsilia Pomona*	Pieridae	Common Emigrant	NA
3	*Pareronia valeria*	Pieridae	Common Wanderer	NA
4	*Arhopala atrax*	Lycaenidae	Indian Oakblue	NA
5	*Loxura atymnus*	Lycaenidae	Yam Fly	NA
6	*Spindasis vuanus*	Lycaenidae	Common Silverline	NA
7	*Pseudozizeeria maha*	Lycaenidae	Pale Grass Blue	NA
8	*Freyeria trochylus*	Lycaenidae	Grass Jewel	NA
9	*Zizinaotis*	Lycaenidae	Lesser Grass Blue	NA
10	*Zizula hylax*	Lycaenidae	Tiny Grass Blue	NA
11	*Euchrysops cnejus*	Lycaenidae	Gram Blue	NA
12	*Abisara echerius*	Lycaenidae	PlumJudy	NA
13	*Danaus chrysippus*	Nymphalidae	Plain Tiger	NA
14	*Euploea core*	Nymphalidae	Common Crow	NA
15	*Melanitis leda*	Nymphalidae	Common Evening Brown	NA
16	*Mycalesis perseus*	Nymphalidae	Common Bush brown	NA
17	*Ypthima huebneri*	Nymphalidae	Common Fourring	NA
18	*Acraea violae*	Nymphalidae	Tawny Coster	NA
19	*Phalanta phalantha*	Nymphalidae	Common Leopard	NA
20	*Euthalia aconthea*	Nymphalidae	Common Baron	NA
21	*Euthalia nais*	Nymphalidae	Baronet	NA
22	*Tanaecia lepidea*	Nymphalidae	GreyCount	NA
23	*Ariadne merione*	Nymphalidae	Common Castor	NA
24.	*Junonia orithiya*	Nymphalidae	Blue Pansy	NA
25.	*Junonia hierta*	Nymphalidae	Yellow Pansy	NA
26.	*Junonia atlites*	Nymphalidae	GreyPansy	NA

27.	*Junonia lemonias*	Nymphalidae	Lemon Pansy	NA
28.	*Hypolimnas bolina*	Nymphalidae	Great Egg fly	NA

Table 4. 16 List of reptiles in core zone

Sl. No.	Species	Family	Common Name	Threat as per IUCN
1.	*Calotes versicolor*	Agamidae	IndianGarden Lizard	Least Concern
2.	*Psammophilus blanfordanus*	Agamidae	Indian Rock Lizard	Least Concern
3.	*Cyrtodactylus nebulosus*	Gekkonidae	Clouded Indian Gecko	Least Concern
4.	*Hemidactylus brookii*	Gekkonidae	House Gecko	Least Concern
5.	*Lygosoma punctuate*	Scincidae	Common skink	Least Concern
6.	*Eutropis carinata*	Scincidae	Keeled Indian Mabuya	Least Concern
7.	*Eutropis macularia*	Scincidae	Grass Sun Skink	Least Concern
8.	*Ahaetulla nasuta*	Colubridae	Vine snake	Not Listed
9.	*Amphiesma stolatum*	Colubridae	Striped keelback	Not Listed
10.	*Boiga trigonata*	Colubridae	Indian gamma snake	Least Concern
11.	*Ptyas mucosus*	Colubridae	Rat snake	Not Listed
12.	*Xenochrophis piscator*	Colubridae	Checkered keelback	Not Listed
13.	*Bungarus caeruleus*	Elapidae	Common krait	Not Listed
14.	*Bungarus fasciatus*	Elapidae	Banded krait	Not Listed
15.	*LycodonJara*	Colubridae	Twin-spotted wolf snake	Least Concern

Table 4. 17 List of reptiles in buffer zone

Sl.no	Family Name	Common Name	Scientific Name	(IWPA,1972)
Sl. No.	**Species**	**Family**	**Common Name**	**Threat as per IUCN**
1	*Calotes versicolor*	Agamidae	IndianGarden Lizard	Least Concern

2	*Psammophilus blanfordanus*	Agamidae	Indian Rock Lizard	Least Concern
3	*Cyrtodactylus nebulosus*	Gekkonidae	Clouded Indian Gecko	Least Concern
4	*Hemidactylus brookii*	Gekkonidae	House Gecko	Least Concern
5	*Lygosoma punctuate*	Scincidae	Common skink	Least Concern
6	*Eutropis carinata*	Scincidae	Keeled Indian Mabuya	Least Concern
7	*Eutropis macularia*	Scincidae	Grass Sun Skink	Least Concern
8	*Ahaetulla nasuta*	Colubridae	Vine snake	Not Listed
9	*Amphiesma stolatum*	Colubridae	Striped keelback	Not Listed
10	*Boiga trigonata*	Colubridae	Indian gamma snake	Least Concern
11	*Ptyas mucosus*	Colubridae	Rat snake	Not Listed
12	*Xenochrophis piscator*	Colubridae	Checkered keelback	Not Listed
13	*Bungarus caeruleus*	Elapidae	Common krait	Not Listed
14	*Bungarus fasciatus*	Elapidae	Banded krait	Not Listed
15	*LycodonJara*	Colubridae	Twin-spotted wolf snake	Least Concern

Table 4. 18 List of amphibians in core zone

Sl.no	Scientific Name	Family	Common Names	Threat as per IUCN

2.	*Duttaphrynus melanostictus*	Bufonidae	Asian Toad	Least Concern
3.	*Fejervarya orissaensis*	Dicroglossidae	Dutta's Cricket Frog	Least Concern
4.	*Hoplobatrachus tigerinus*	Dicroglossidae	Indian Bull Frog	Least Concern
5.	*Polypedates maculatus*	Racophoridae	Indian Tree frog	Least Concern

Table 4. 19 List of amphibians in buffer zone

Sl.no	Scientific Name	Family	Common Names	Threat as per IUCN
6.	*Duttaphrynus melanostictus*	Bufonidae	Asian Toad	Least Concern
7.	*Fejervarya orissaensis*	Dicroglossidae	Dutta's Cricket Frog	Least Concern
8.	*9. Hoplobatrachus tigerinus*	Dicroglossidae	Indian Bull Frog	Least Concern
10.	*Polypedates maculatus*	Racophoridae	Indian Tree frog	Least Concern

Fig 4. 5 Sloth bear scratch

Gps coordinates:N 21°47’27.3” E 8507’31.5”

Fig 4. 6 Wild boar scratch mark

Gps coordinates: N 21°49’16.1” E 85°08’54.7”

Fig 4. 7 Leopard footprint

Gps coordinates: N 21°49’19.2” E 85°07’48.2”

Fig.4.9 hyena footprint

Gps coordinates: N 21°49’19.2” E 85°67’47.9”

Fig 4. 8 Elephant dung

Gps coordinates: N 21°49'15.7" E 85°08'55.5"

4.1.3 Faunal Diversity for Phase III –winter season

A number of faunal varieties were documented in the core zone including 64 individual birds belonging to 36 different families, 26 individual butterflies from 4 families. 9 species of mammals of 9 families and 2 species of reptiles belonging to 2 families.Whereas in the core zone, During the study period , a total of 51species of birds belonging to 27 families were recorded in different transects, 17 butterflies from 4 different families were recorded , 8 mammals and 10 reptile species of 3 different families were also recorded.

Table 4. 20 Check List of Mammals in the core zone

Sl.No	Family Name	Local / Common name	Scientific Name	Evidence found	(IWPA,1972)
1	Ursidae	Sloth Bear	*Melursus ursinus*	Scats	I
2	Hyaenidae	Stripe Hyena	*Hyaena hyaena*	footprints	III
3	Canidae	Jackal	*Canis aureus*	footprints	II
4	Cervidae	Barking Deer	*Muntiacus muntjak*	Scats and hoop marks	III

5	Hysticidae	Porcupine	*Hystrix indica*	Stings and hoop marks	II
6	Cercopithecidae	Rhesus Macaque	*Macaca mulatta*	Scats	II
7	Suidae	Wild Pig	*Sus scrofa*	Burrows	III
8	Leporidae	Indian Hare	*Lepus nigricollis*	Scats	III
9	Felidae	Jungle Cat	*Felis chaus*	Claw marks	II

Table 4. 21 Check List of Mammals in the buffer zone

Sl.No	Family Name	Local / Common name	Scientific Name	Evidence found	(IWPA,1972)
1	*Canis aureus*	Canidae	Jackal	Evidences (footprints)	SchII
2	*Canis lupus*	Canidae	Indian Wolf	Evidences (footprints)	SchII
3	*Felis chaus*	Felidae	Jungle Cat	Evidences (footprints)	SchII
4	*Lepus nigricollis*	Leporidae	Indian Hare	Evidences (Pellet)	SchIII
5	*Suncus murinus*	Soricidae	House Shrew		SchIV
6	*Hystrix indica*	Hystricidae	Indian Porcupine	Evidences (Pellet)	SchIV
7	*Funambulus palmarum*	Sciuridae	Three-striped Palm Squirrel	Sighting	Least Concern
8	*Bandicota bengalensis*	Muridae	Lesser Bandicoot-rat	Burrow	Least Concern

Table 4. 22 Checklist of birds in the core zone

Sl. No	Family Name	Local / Common name	Scientific Name	Threat as per IUCN
1	Phasianidae	Red Jungle Fowl	*Gallus gallus*	Least Concern
		Pea Fowl	*Pavo cristatus*	

2		Painted Francolin	*Francolinus pictus*	Least Concern
3	Ardeidae	Indian Pond Heron	*Ardeola grayii*	Least Concern
4		Cattle Egret	*Bubulcus ibis*	Least Concern
5		Little Egret	*Egretta garzetta*	Least Concern
6	Phalacrocoracidae	Little Cormorant	*Phalacrocorax niger*	Least Concern
7	Accipitridae	Black Kite	*Milvus migrans*	Least Concern
8		Shikra	*Accipiter badius*	Least Concern
9		Indian Black Eagle	*Ictinaetus malayensis*	Least Concern
10		Black- Shouldered Kite	*Elanus caeruleus*	Least Concern
11		Osprey	*Pandion haliaetus*	Least Concern
12	Columbidae	Oriental Turtle Dove	*Streptopelia orientalis*	Least Concern
13		Yellow-Legged Green Pigeon	*Treron phoenicoptera*	Least Concern
14		Spotted-Necked Dove	*Streptopelia chinensis*	Least Concern
15	Psittacidae	Alexandrine Parakeet	*Psittacula eupatria*	Least Concern
16		Rose-RingedParakeet	*Psittacula krameri*	Least Concern
17		Plum-Headed Parakeet	*Psittacula cyanocephala*	Least Concern
18	Cuculidae	Indian Cuckoo	*Cuculus micropterus*	Least Concern
19		Eurasian Cuckoo	*Cuculus canorus*	Least Concern
20		Greater Coucal	*Centropus sinensis*	Least Concern
21	Tytonidae	Jungle Owlet	*Glaucidium radiatum*	Least Concern
22		Spotted Owlet	*Athene brama*	Least Concern

23	Caprimulgidae	Indian Nightjar	*Caprimulgus asiaticus*	Least Concern
24	Apodidae	Little Swift	*Apus affinis*	Least Concern
25		House Swift	*Apus affinis*	Least Concern
26	Coraciidae	Indian Roller	*Coracias benghalensis*	Least Concern
27	Upupidae	Common Hoopoe	*Upupa epops*	Least Concern
28	Meropidae	Green Bee-Eater	*Merops orientalis*	Least Concern
29	Bucerotidae	Indian GreyHornbill	*Ocyceros birostris*	Least Concern
30	Ramphastidae	Brown-Headed Barbet	*Megalaima zeylanica*	Least Concern
31	Picidae	Speckled Piculet	*Picumnus innominatus*	Least Concern
32	Campephagidae	Large Cuckoo-Shrike	*Coracina macei*	Least Concern
33		Small Minivet	*Pericrocotus cinnamomeus*	Least Concern
34	Oriolidae	Black-Hooded Oriole	*Oriolus xanthornus*	Least Concern
35	Dicruridae	Greater Racket-Tailed Drongo	*Dicrurus paradiseus*	Least Concern
36		Black Drongo	*Dicrurus macrocercus*	Least Concern
37	Rhipiduridae	White-Browed Fantail	*Rhipidura aureola*	Least Concern
38	Corvidae	Rufous Treepie	*Dendrocitta vagabunda*	Least Concern
39		House Crow	*Corvus splendens*	Least Concern
40		Large-Billed Crow/Jungle Crow	*Corvus macrorhynchos*	Least Concern
41	Paridae	Great Tit	*Parus major*	Least Concern
42	Pycnonotidae	Red-Vented Bulbul	*Pycnonotus cafer*	Least Concern

43	Sylviidae	Greenish Warbler	*Phylloscopus trochiloides*	Least Concern
44		Tickell's Leaf Warbler	*Phylloscopus affinis*	Least Concern
45		Thick-Billed Warbler	*Phragamaticola aedon*	Least Concern
46	Timaliidae	Jungle Babbler	*Turdoides striatus*	Least Concern
47		Indian Scimitar Babbler	*Pomatorhinus horsfieldii*	Least Concern
48	Zosteropidae	Oriental White-Eye	*Zosterops palpebrosus*	Least Concern
49	Sittidae	Chestnut-Bellied Nuthatch	*Sitta castanea*	Least Concern
50	Sturnidae	Common Myna	*Acridotheres tristis*	Least Concern
51		Asian Pied Starling	*Sturnus contra*	Least Concern
52	Turdidae	Blue Whistling Thrush	*Myophonus caeruleus*	Least Concern
53	Muscicapidae	Oriental Magpie-Robin	*Copsychus saularis*	Least Concern
54		Indian Robin	*Saxicoloides fulicata*	Least Concern
55	Chloropseidae	Blue-Winged Leaf Bird	*Chloropsis cochinchinensis*	Least Concern
56	Nectariniidae	Purple Sunbird	*Nectarinia asiatica*	Least Concern
57		Crimson Sunbird	*Aethopyga siparaja*	Least Concern
58	Passeridae	House Sparrow	*Passer domesticus*	Least Concern
59	Motacillidae	Yellow Wagtail	*Motacilla flava*	Least Concern
60		GreyWagtail	*Motacilla cinerea*	Least Concern
61		White Wagtail	*Motacillaalba*	Least Concern
62	Laniidae	Long-Tailed Shrike	*Lanius schach*	Least Concern
63		Grey-BackedShrike	*Lanius tephronotus*	Least Concern

64	Campephagidae	Small Minivet	*Pericrocotus cinnamomeus*	Least Concern

Table 4. 23 Checklist of birds in buffer zone

Sl. No	Family Name	Local / Common name	Scientific Name	Threat as per IUCN
1	Phasianidae	Red Jungle Fowl	*Gallus gallus*	Least Concern
2	Ardeidae	Painted Francolin	*Francolinus pictus*	Least Concern
3		Indian Pond Heron	*Ardeola grayii*	Least Concern
4		Cattle Egret	*Bubulcus ibis*	Least Concern
5		Little Egret	*Egretta garzetta*	Least Concern
6	Phalacrocoracidae	Little Cormorant	*Phalacrocorax niger*	Least Concern
7	Accipitridae	Black Kite	*Milvus migrans*	Least Concern
8		Shikra	*Accipiter badius*	Least Concern
9		Indian Black Eagle	*Ictinaetus malayensis*	Least Concern
10		Black- Shouldered Kite	*Elanus caeruleus*	Least Concern
11		Osprey	*Pandion haliaetus*	Least Concern
12	Columbidae	Oriental Turtle Dove	*Streptopelia orientalis*	Least Concern
13		Yellow-Legged Green Pigeon	*Treron phoenicoptera*	Least Concern
14		Spotted-Necked Dove	*Streptopelia chinensis*	Least Concern
15	Psittacidae	Alexandrine Parakeet	*Psittacula eupatria*	Least Concern
16		Rose-RingedParakeet	*Psittacula krameri*	Least Concern
17		Plum-Headed Parakeet	*Psittacula cyanocephala*	Least Concern
18	Cuculidae	Indian Cuckoo	*Cuculus micropterus*	Least Concern
19		Eurasian Cuckoo	*Cuculus canorus*	Least Concern
20		Greater Coucal	*Centropus sinensis*	Least Concern
21	Tytonidae	Jungle Owlet	*Glaucidium radiatum*	Least Concern
22		Spotted Owlet	*Athene brama*	Least Concern
23	Caprimulgidae	Indian Nightjar	*Caprimulgus asiaticus*	Least Concern
24	Apodidae	Little Swift	*Apus affinis*	Least Concern
25		House Swift	*Apus affinis*	Least Concern

26	Coraciidae	Indian Roller	*Coracias benghalensis*	Least Concern
27	Upupidae	Common Hoopoe	*Upupa epops*	Least Concern
28	Paridae	Great Tit	*Parus major*	Least Concern
29	Pycnonotidae	Red-Vented Bulbul	*Pycnonotus cafer*	Least Concern
30	Sylviidae	Greenish Warbler	*Phylloscopus trochiloides*	Least Concern
31		Tickell's Leaf Warbler	*Phylloscopus affinis*	Least Concern
32		Thick-Billed Warbler	*Phragamaticola aedon*	Least Concern
33	Timaliidae	Jungle Babbler	*Turdoides striatus*	Least Concern
34		Indian Scimitar Babbler	*Pomatorhinus horsfieldii*	Least Concern
35	Zosteropidae	Oriental White-Eye	*Zosterops palpebrosus*	Least Concern
36	Sittidae	Chestnut-Bellied Nuthatch	*Sitta castanea*	Least Concern
37	Sturnidae	Common Myna	*Acridotheres tristis*	Least Concern
38		Asian Pied Starling	*Sturnus contra*	Least Concern
39	Turdidae	Blue Whistling Thrush	*Myophonus caeruleus*	Least Concern
40	Muscicapidae	Oriental Magpie-Robin	*Copsychus saularis*	Least Concern
41		Indian Robin	*Saxicoloides fulicata*	Least Concern
42	Chloropseidae	Blue-Winged Leaf Bird	*Chloropsis cochinchinensis*	Least Concern
43	Nectariniidae	Purple Sunbird	*Nectarinia asiatica*	Least Concern
44		Crimson Sunbird	*Aethopyga siparaja*	Least Concern
45	Passeridae	House Sparrow	*Passer domesticus*	Least Concern
46	Motacillidae	Yellow Wagtail	*Motacilla flava*	Least Concern
47		GreyWagtail	*Motacilla cinerea*	Least Concern
48		White Wagtail	*Motacillaalba*	Least Concern
49	Laniidae	Long-Tailed Shrike	*Lanius schach*	Least Concern
50		Grey-BackedShrike	*Lanius tephronotus*	Least Concern
51	Campephagidae	Small Minivet	*Pericrocotus cinnamomeus*	Least Concern

Table 4. 24 List of Butterflies in the core zone

Sl.No	Family Name	Local / Common name	Scientific Name	(IWPA,1972)

1	Papilionidae	Lime Buttrefly	*Papilio demoleus*	NA
2		Common Mormon	*Papilio polytes*	NA
3		Common Bluebottle	*Graphium sarpedon*	NA
4		Common Mime	*Chilasa mime*	NA
5	Pieridae	Indian Cabbage White	*Pieris canida*	NA
6		Red-Base Jezebel	*Delias pasithoe*	NA
7		Common Jezebel	*Delias eucharis*	NA
8	Lycaenidae	Large Oak Blue	*Arhopala amantes*	NA
9		PlumJudy	*Abisaran echerius*	NA
10	Nymphalidae	Common Nawab	*Polyura anthamas*	NA
11		Great Evening Brown	*Melanitis zitenius*	NA
12		Common Sailer	*Neptis hylas*	NA
13		Gaudy Baron	*Euthalia lubentina*	NA
14		Striped Tiger	*Danaus genutia*	NA
15		Glassy Tiger	*Parantica aglea*	NA
16		Plain Tiger	*Danaus chrysippus*	NA
17		Chestnut Tiger	*Parantica sita*	NA
18		Common Crow	*Euploea core*	NA
19		Common Evening Brown	*Melanitis leda*	NA
20		Common Four-Ring	*Ypthima huebneri*	NA
21		Indian Red Admiral	*Vanessa indica*	NA
22		GreyPansy	*Junonia atlites*	NA
23		Peacock Pansy	*Junonia almanac*	NA

24		Blue Pansy	*Junonia oritya*	NA
25		Great Egg Fly	*Hypolimnas bolina*	NA
26		Common Castor	*Ariadne merione*	NA

Table 4. 25 List of butterflies in buffer zone

Sl.No	Family Name	Local / Common name	Scientific Name	(IWPA,1972)
1	Papilionidae	Lime Buttrefly	*Papilio demoleus*	NA
2		Common Mormon	*Papilio polytes*	NA
3		Common Bluebottle	*Graphium sarpedon*	NA
4		Common Mime	*Chilasa mime*	NA
5	Pieridae	Indian Cabbage White	*Pieris canida*	NA
6		Red-Base Jezebel	*Delias pasithoe*	NA
7		Common Jezebel	*Delias eucharis*	NA
8	Lycaenidae	Large Oak Blue	*Arhopala amantes*	NA
9		PlumJudy	*Abisaran echerius*	NA
10	Nymphalidae	Common Nawab	*Polyura anthamas*	NA
11		Great Evening Brown	*Melanitis zitenius*	NA
12		Common Sailer	*Neptis hylas*	NA
13		Gaudy Baron	*Euthalia lubentina*	NA
14		Striped Tiger	*Danaus genutia*	NA
15		Glassy Tiger	*Parantica aglea*	NA
16		Plain Tiger	*Danaus chrysippus*	NA
17		Chestnut Tiger	*Parantica sita*	NA

Table 4. 26 List of reptiles in core zone

Sl.No	Family Name	Local / Common name	Scientific Name	(IWPA,1972)
1	Scincidae	IndianForest Skink	*Sphenomorphus indicus*	NA
2	Agamidae	IndianGarden Lizard	*Calotes versicolor*	NA

Table 4. 27List of reptiles in buffer zone:

Sl. No.	Species	Family	Common Name	Threat as per IUCN
1	*Eutropis carinata*	Scincidae	Keeled Indian Mabuya	Least Concern
2	*Eutropis macularia*	Scincidae	Grass Sun Skink	Least Concern
3	*Ahaetulla nasuta*	Colubridae	Vine snake	Not Listed
4	*Amphiesma stolatum*	Colubridae	Striped keelback	Not Listed
5	*Boiga trigonata*	Colubridae	Indian gamma snake	Least Concern
6	*Ptyas mucosus*	Colubridae	Rat snake	Not Listed
7	*Xenochrophis piscator*	Colubridae	Checkered keelback	Not Listed
8	*Bungarus caeruleus*	Elapidae	Common krait	Not Listed
9	*Bungarus fasciatus*	Elapidae	Banded krait	Not Listed
10	*Lycodon Jara*	Colubridae	Twin-spotted wolf snake	Least Concern

Table 4. 28 List of amphibians in core zone

Sl No.	Family	Scientific Name	Common Names	Threat as per IUCN
1		*Rana tigrina*	Indian Bull Frog	Least concern
2		*Rana hexdactyla*	Frog	Least concern

Table 4. 29 List of amphibians in buffer zone

Sl No.	Family	Scientific Name	Common Names	Threat as per IUCN
1		*Rana tigrina*	Indian Bull Frog	Least concern
2		*Rana hexdactyla*	Frog	Least concern

Fig 4. 9 Barking deer scat

Gps coordinates: N 21°49’29.83” E 85°08’35.5”

Fig 4. 10 Monkey scat

Gps coordinates: N 21°51’26.2” E 85°10’32.3”

Fig 4. 11 Sloth Bear Scat

Gps coordinates: N 21°49’28.3” E 85°07’30.1”

Fig 4. 12 Wild boar scratch

Gps coordinates: N 21°5’29.4” E 85°10’32.3”

4.1.4 Faunal diversity for phase IV-Spring season

The number of faunal species listed in the core zone includes 41 species of birds from 26 families,9 species of butterflies from 3 families,8 species of mammals,5 species of reptiles from 3 different families. Whereas 24 species of birds belonging to 15 different families,8 species of butterflies from 3 families,7 species of mammals and 8 species of reptiles were recorded in the buffer zone.

Table 4. 30 Checklist of mammals in Core zone

Sl.No	Family Name	Common name	Scientific Name		(IWPA,1972)
1		Bat	*Cynopterus sphnix*		-
2		Musa	*Rattus rattus*		-
3		Squirrel	*Funambulus pennati*		Least concern
4	Canidae	Jackal	*Canis aureus*	Evidences (Scat)	II
5	Felidae	Jungle Cat	*Felis chaus*	Evidences (Scat)	II
6	Hysticidae	Porcupine	*Hystrix indica*	Stings and hoop marks	II
7	Cercopithecidae	Rhesus Macaque	*Macaca mulatta*	Scats	II
8	Suidae	Wild Pig	*Sus scrofa*	Burrows	III

Table 4. 31 Checklist of mammals in buffer zone

Sl.no.	Scientific Name	Family	Common Name	Type of Observations Sighting or Evidences	Indian Wildlife Protection Act (IWPA)**
17.	*Macaca mulatta*	Cercopithecidae	Rhesus Macaque	Sighting	SchII
18.	*Muntiacus muntjak*	Cervidae	Barking Deer	Sighting	SchIII
19.	*Sus scrofa*	Suidae	Wild Pig	Evidences (Feeding sign)	SchIII
20.	*Melursus ursinus*	Ursidae	Sloth Bear	Evidences (Scratch)	Sch I

21.	*Canis aureus*	Canidae	Jackal	Evidences (footprints)	SchII
22.	*Canis lupus*	Canidae	Indian Wolf	Evidences (Scat)	SchII
23.	*Felis chaus*	Felidae	Jungle Cat	Evidences (Scat)	SchII

Table 4. 32Checklist of butterflies in core zone

Sl.No	Family Name	Local / Common name	Scientific Name	(IWPA,1972)
1	Papilionidae	Lime Buttrefly	*Papilio demoleus*	NA
2		Common Mormon	*Papilio polytes*	NA
3		Common Bluebottle	*Graphium sarpedon*	NA
4		Common Mime	*Chilasa mime*	NA
5	Pieridae	Indian Cabbage White	*Pieris canida*	NA
6		Red-Base Jezebel	*Delias pasithoe*	NA
7		Common Jezebel	*Delias eucharis*	NA
8	Lycaenidae	Large Oak Blue	*Arhopala amantes*	NA
9		Plum Judy	*Abisaran echerius*	NA

Table 4. 33 Checklist of butterflies in the buffer zone

Sl. No.	Scientific Name	Family	Common Name	Threat as per IUCN
29.	*Sarangesa dasahara*	Hesperiidae	Common Small Flat	NA
30.	*Tagiades gana*		Suffused Snow Flat	NA
31.	*Spialiagalba*		Indian Skipper	NA
32.	*Oriens goloides*		Common Dartlet	NA
33.	*Zizula hylax*	Lycaenidae	Tiny Grass Blue	NA
34.	*Euchrysops cnejus*		Gram Blue	NA
35.	*Abisara echerius*		PlumJudy	NA
36.	*Danaus chrysippus*	Nymphalidae	Plain Tiger	NA

Table 4. 34 Checklist of birds in the core zone:

Sl. No.	Family	Scientific Name	Common Name	Threat as per IUCN
1	Accipitridae	*Elanus caeruleus*	Black-shouldered Kite	Least Concern
2	Accipitridae	*Accipiter badius dussumieri*	Indian shikra	
3	Phasianidae	*Gallus gallus*	Red Junglefowl	Least Concern
4	Columbidae	*Columba livia*	Blue Rock Pigeon	Least Concern
5	Columbidae	*Streptopelia chinensis*	Spotted Dove	Least Concern
6	Psittacidae	*Psittacula krameri*	Rose-ringed Parakeet	Least Concern
7	Cuculidae	*Cuculus canorus*	Common Cuckoo	Least Concern
8	Cuculidae	*Eudynamys scolopacea*	Asian Koel	Least Concern
9	Strigidae	*Athene brama*	Spotted Owlet	Least Concern
10	Caprimulgidae	*Caprimulgus asiaticus*	Common Indian Nightjar	Least Concern
11	Caprimulgidae	*Caprimulgus indicus*	Indian Jungle Nightjar	Least Concern
12	Apodidae	*Cypsiurus balasiensis*	Asian Palm-Swift	Least Concern
13	Apodidae	*Apus affinis*	House Swift	Least Concern
14	Meropidae	*Merops orientalis*	Small Bee-eater	Least Concern
15	Coraciidae	*Coracias benghalensis*	Indian Roller	Least Concern
16	Capitonidae	*Megalaima zeylanica*	Brown-headed Barbet	Least Concern
17	Capitonidae	*Megalaima haemacephala*	Coppersmith Barbet	Least Concern
18	Motacillidae	*Anthus rufulus*	Paddyfield Pipit	Least Concern
19	Campephagidae	*Coracina macei*	Large Cuckoo-Shrike	Least Concern

20	Campephagidae	*Pericrocotus flammeus* (Forster, 1781)	Scarlet Minivet	Least Concern
21	Pycnonotidae	*Pycnonotus jocosus*	Red-whiskered Bulbul	Least Concern
22	Pycnonotidae	*Pycnonotus cafer*	Red-vented Bulbul	Least Concern
23	Turdinae	*Copsychus saularis*	Oriental Magpie-Robin	Least Concern
24	Turdinae	*Copsychus malabaricus*	White-rumped Shama	Least Concern
25	Turdinae	*Saxicoloides fulicata*	Indian Robin	Least Concern
26	Timaliinae	*Turdoides caudatus*	Common Babbler	Least Concern
27	Timaliinae	*Turdoides striatus*	Jungle Babbler	Least Concern
28	Sylviinae	*Prinia sylvatica*	Jungle Prinia	Least Concern
29	Sylviinae	*Orthotomus sutorius*	Common Tailorbird	Least Concern
30	Dicaeidae	*Dicaeum agile*	Thick-billed Flowerpecker	Least Concern
31	Nectariniidae	*Nectarinia asiatica*	Purple Sunbird	Least Concern
32	Nectariniidae	*Nectarinia zeylanica*	Purple rumped sunbird	Least Concern
33	Zosteropidae	*Zosterops palpebrosus*	Oriental White-eye	Least Concern
34	Estrildidae	*Lonchura punctulata*	Spotted Munia	Least Concern
35	Passerinae	*Passer domesticus*	House Sparrow	Least Concern
36	Sturnidae	*Sturnus contra*	Asian Pied Starling	Least Concern
37	Sturnidae	*Acridotheres tristis*	Common Myna	Least Concern
38	Oriolidae	*Oriolus xanthornus*	Black-headed Oriole	Least Concern

39	Dicruridae	*Dicrurus macrocercus*	Black Drongo	Least Concern
40	Corvidae	*Dendrocitta vagabunda*	Indian Treepie	Least Concern
41	Corvidae	*Corvus splendens*	House Crow	Least Concern

Table 4. 35 Checklist of birds in the buffer zone

Sl. No.	Family	Scientific Name	Common Name	Threat as per IUCN
1	Cuculidae	*Cuculus canorus*	Common Cuckoo	Least Concern
2	Cuculidae	*Eudynamys scolopacea*	Asian Koel	Least Concern
3	Strigidae	*Athene brama*	Spotted Owlet	Least Concern
4	Caprimulgidae	*Caprimulgus asiaticus*	Common Indian Nightjar	Least Concern
5	Caprimulgidae	*Caprimulgus indicus*	Indian Jungle Nightjar	Least Concern
6	Apodidae	*Cypsiurus balasiensis*	Asian Palm-Swift	Least Concern
7	Apodidae	*Apus affinis*	House Swift	Least Concern
8	Meropidae	*Merops orientalis*	Small Bee-eater	Least Concern
9	Campephagidae	*Pericrocotus flammeus*	Scarlet Minivet	Least Concern
10	Pycnonotidae	*Pycnonotus jocosus*	Red-whiskered Bulbul	Least Concern
11	Pycnonotidae	*Pycnonotus cafer*	Red-vented Bulbul	Least Concern
12	Turdinae	*Copsychus saularis*	Oriental Magpie-Robin	Least Concern
13	Turdinae	*Copsychus malabaricus*	White-rumped Shama	Least Concern
14	Turdinae	*Saxicoloides fulicata*	Indian Robin	Least Concern
15	Timaliinae	*Turdoides caudatus*	Common Babbler	Least Concern
16	Timaliinae	*Turdoides striatus*	Jungle Babbler	Least Concern
17	Estrildidae	*Lonchura punctulata*	Spotted Munia	Least Concern
18	Passerinae	*Passer domesticus*	House Sparrow	Least Concern
19	Sturnidae	*Sturnus contra*	Asian Pied Starling	Least Concern
20	Sturnidae	*Acridotheres tristis*	Common Myna	Least Concern
21	Oriolidae	*Oriolus xanthornus*	Black-headed Oriole	Least Concern
22	Dicruridae	*Dicrurus macrocercus*	Black Drongo	Least Concern

23	Corvidae	*Dendrocitta vagabunda*	Indian Treepie	Least Concern
24	Corvidae	*Corvus splendens*	House Crow	Least Concern

Table 4. 36 Checklist of reptiles in the core zone

Sl. No.	Family	Zological Name	Common Name	Threat as per IUCN
1	Elapidae	*Bungarus fasciatus*	Banded Krait	Least concern
2	Agamidae	*Calotes versicolor*	Garden Lizard	Least Concern
3	Colubridae	*Ptyas mucosus*	Rat snake	Not Listed
4	Colubridae	*Xenochrophis piscator*	Checkered keelback	Not Listed
5	Elapidae	*Bungarus caeruleus*	Common krait	Not Listed

Table 4. 37 Checklist of reptiles in the buffer zone

Sl. No.	Species	Family	Common Name	Threat as per IUCN
16.	*Calotes versicolor*	Agamidae	IndianGarden Lizard	Least Concern
17.	*Psammophilus blanfordanus*	Agamidae	Indian Rock Lizard	Least Concern
18.	*Cyrtodactylus nebulosus*	Gekkonidae	Clouded Indian Gecko	Least Concern
19.	*Hemidactylus brookii*	Gekkonidae	House Gecko	Least Concern
20.	*Lygosoma punctuate*	Scincidae	Common skink	Least Concern
21.	*Eutropis carinata*	Scincidae	Keeled Indian Mabuya	Least Concern
22.	*Bungarus fasciatus*	Elapidae	Banded krait	Not Listed
23.	*LycodonJara*	Colubridae	Twin-spotted wolf snake	Least Concern

Table 4. 38 Checklist of amphibians in the core zone

Sl. No.	Family	Scientific Name	Common Names	Threat as per IUCN
1		*Rana tigrina*	Indian Bull Frog	Least concern
2		*Rana hexdactyla*	Frog	Least concern

Table 4. 39 Checklist of amphibians in the buffer zone

Sl.no	Scientific Nam	Family	Common Names	Threat as per IUCN
11.	*Hoplobatrachus tigerinus*	Dicroglossidae	Indian Bull Frog	Least Concern
12.	*Polypedates maculatus*	Racophoridae	Indian Tree frog	Least Concern

Fig 4. 14 Barking deer footprint

Gps coordinates: N 21°48’33” E 85°11’67”

Fig 4. 15 Monkey scat

Gps coordinates: N 21°51’67” E 85°11’54.3”

Fig 4. 16 Cobra habitat

Gps coordinates: N 21°49’20” E 85°08’19.4”

Fig 4. 13 Cobra habitat

Gps coordinates: N 21°49’19.2” E 85°07’47.6”

4.2 Collection and Visual analysis of Scat

Summer season: During the survey of the study area in summer season, two scat samples were collected shown below as Fig.18 and Fig.19

Fig 4. 18 Sample-1: The Scat was analysed and identified to have been excreted from Sloth Bear species

Fig 4. 19 Sample -2: The scat was analysed and identified to have been excreted by Sloth Bear

Table 4. 40 Identification of Sample 1 Scat Composition

Family	Local Name	Scientific Name
Rhamanaceae	Kantaikoli	Ziziphus oenoplia
Poaceae	Barmunda grass	Cynodon dactylon
Rutaceae	Bel	Aegle marmelos
Rhamanaceae	Borkuli	Ziziphus mauritiana

Table 4. 41 Identification of Sample 2 Scat Composition

Family	Local name	Scientific Name
Poaceae	Barmunda grasees	Cynodon dactylon
Verbenaceae	Putush	Lantana camara

Rainy season: During the survey of the study area in rainy season,4 samples were collected as shown below Fig.20,Fig.21,Fig.22,Fig 23

Fig 4. 20 Sample 1: The scat was analysed and identified to have been excreted from Peacock species

Fig 4. 21 sample 2:The scat was analysed and identified to have been excreted from Wild hen species

Table 4. 42 Identification of Sample 1- Scat composition

Constituents

Insect skin
Bettle shells
Pavo cristatus
Cracked corn

Table 4. 43 Identification of Sample 2-Scat composition

Family	Local Name	Scientific Name
Rhamanaceae	Kantoikoli	Ziziphus oenoplia

Fig 4. 15 Sample 4 : The scat was analysed and identified to have been excreted from Sloth Bear species

Fig 4. 14 Sample 3: The scat was analysed and identified to have been excreted from Elephant species

Table 4. 44 Identification of Sample 3-scat composition

Family	Local Name	Scientific Name
Rhamanaceae	Kantoikoli	Ziziphus oenoplia
Poaceae	Barmunda grasees	Cynodon dactylon
Ebenaceae	kendu	Diospyrus melanoxylon

Table 4. 45 Identification of Sample4 –Scat composition

Consituents
Termites
Black ants
Red Ants
Ziziphus oenoplia
Cynodon dactylon

Winter season: During the survey of the study area in rainy season,4 samples were collected as shown below Fig.24,Fig.25,Fig.26,Fig 27

Fig 4. 16 Sample 1: The scat was analysed and identified to have been excreted from Barking Deer species

Fig 4. 17 Sample 2: The scat was analysed and identified to have been excreted from Sloth Bear species

Table 4. 46Identification of Sample 1-scat composition

Family	Local name	Scientific name
Bambusoidae	Bamboo barks	Bambusae
Poaceae	Barmunda grasees	Cynodon dactylon

Table 4. 47 Identification of Sample 2-scat composition

Constituents
Ziziphus oenoplia
Termites

Fig 4. 19 Sample 3: The scat was analysed and identified to have been excreted from Peafowl species

Fig 4. 18 Sample 4: The scat was analysed and identified to have been excreted from Monkey species

Table 4. 48 Identification of Sample 3-scat composition

Family	Local name	Scientific Name
Poaceae	Barmunda grasees	Cynodon dactylon
Rhamanaceae	Kantoikoli	Ziziphus oenoplia
-	Twigs	-

Table 4. 49 Identification of Sample 4-scat composition

Constituents
Ziziphus oenoplia
termites

Spring Season: During the survey of the study area in rainy season, 2 samples were collected as shown below Fig.31 and Fig.32

Fig 4. 28 Sample 1: The scat was analysed and identified to have been excreted from Sloth Bear species

Fig 4. 29 Sample 3: The scat was analysed and identified to have been excreted from Monkey species

Table 4. 50 Identification of Sample 1-scat composition

Family	Local name	Scientific name
Poaceae	Barmunda grasees	Cynodon dactylon
Rhamanaceae	Kantoikoli	Ziziphus oenoplia
Ebenaceae	Kendu	Diospyrus melanoxylon

Table 4. 51 Identification of Sample 2-scat composition

Constituents
Ziziphus leaves
Ziziphus seeds

4.3 Qualitative Analysis of carbohydrates of Scat sample:

I. Carbohydrate(molisch Test)

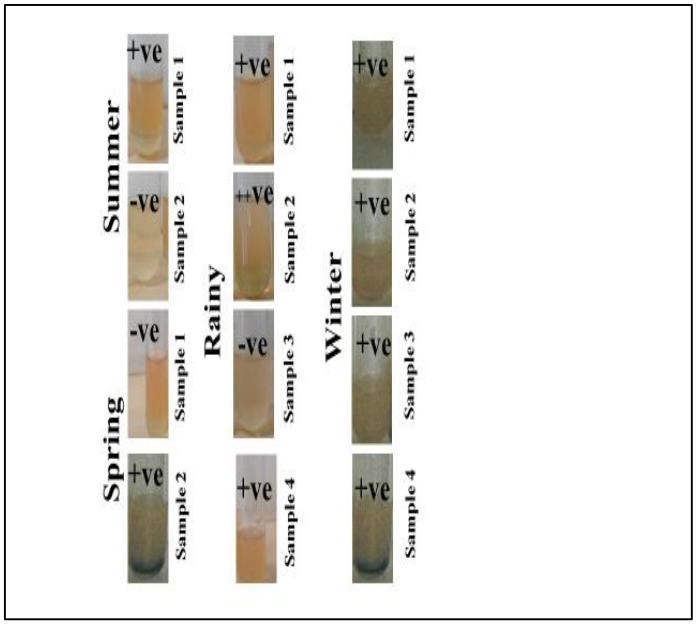


Fig 4. 20 Carbohydrate test

II. Protein test(Bradford test)

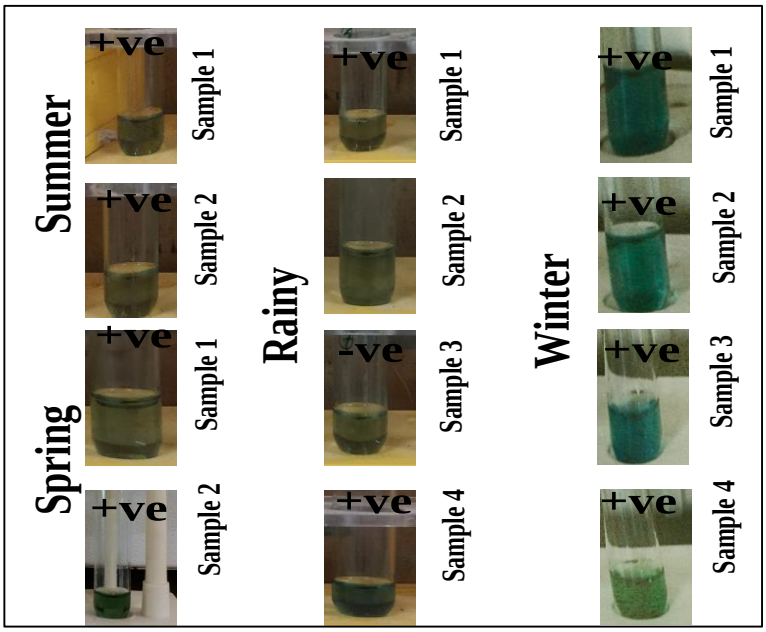


Fig 4. 21 Protein test

III. Cholesterol test (Libermann Buchard)

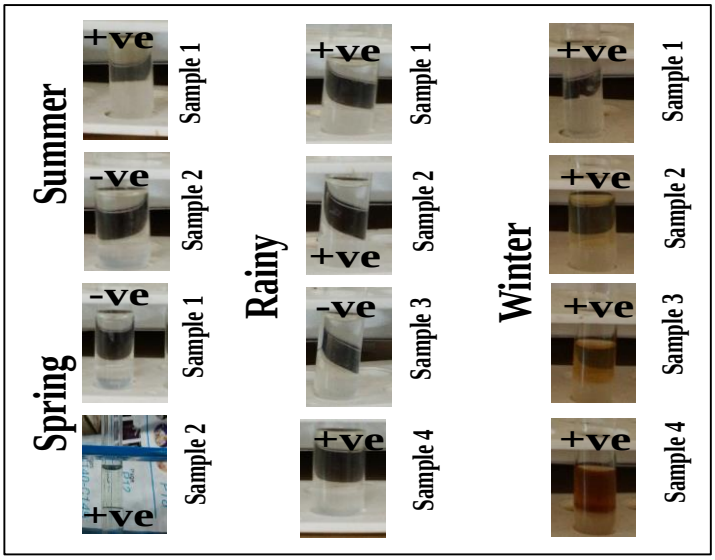


Fig 4. 22 Cholesterol test

4.4 *Comparative study of the quantitative test for various components in the scat samples collected season wise:*

a) Summer Season:

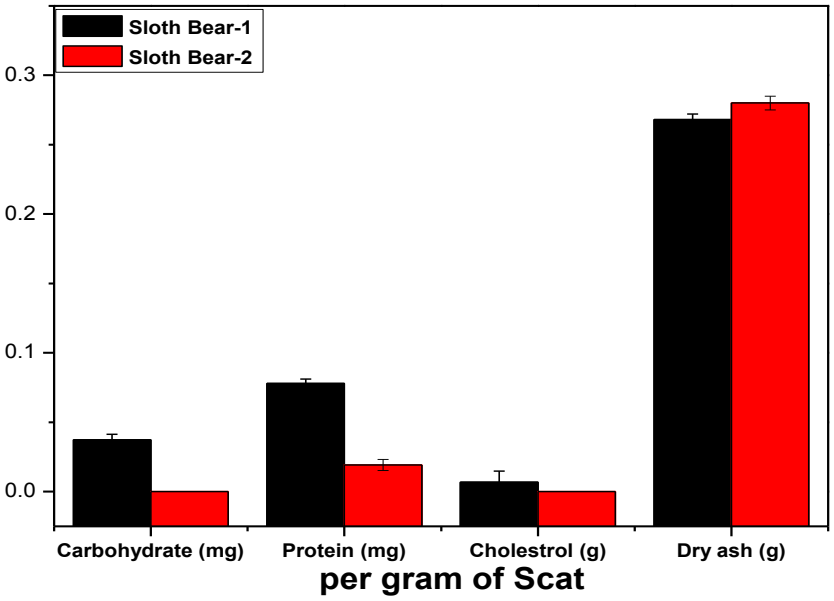


Fig.4.33 Statistical analysis of dietary composition during summer season

b) Rainy season:

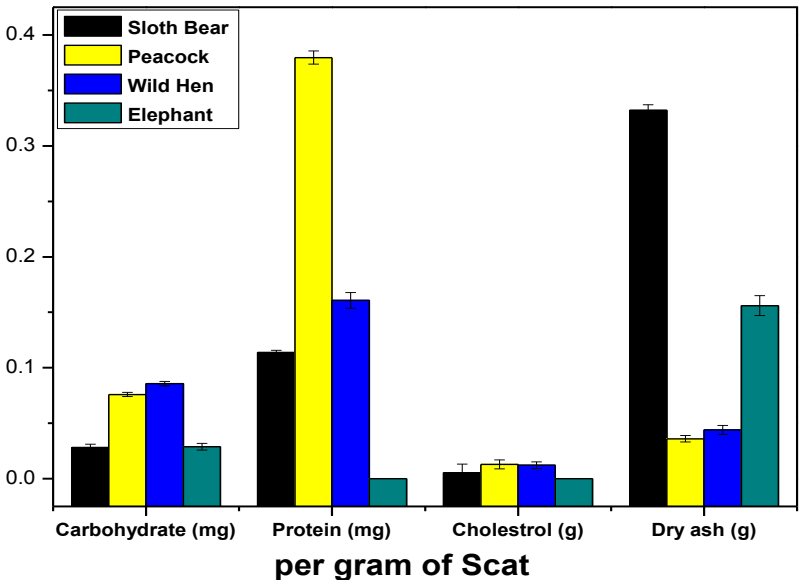


Fig.4.34 Statistical analysis of dietary composition during rainy season

c) Winter season

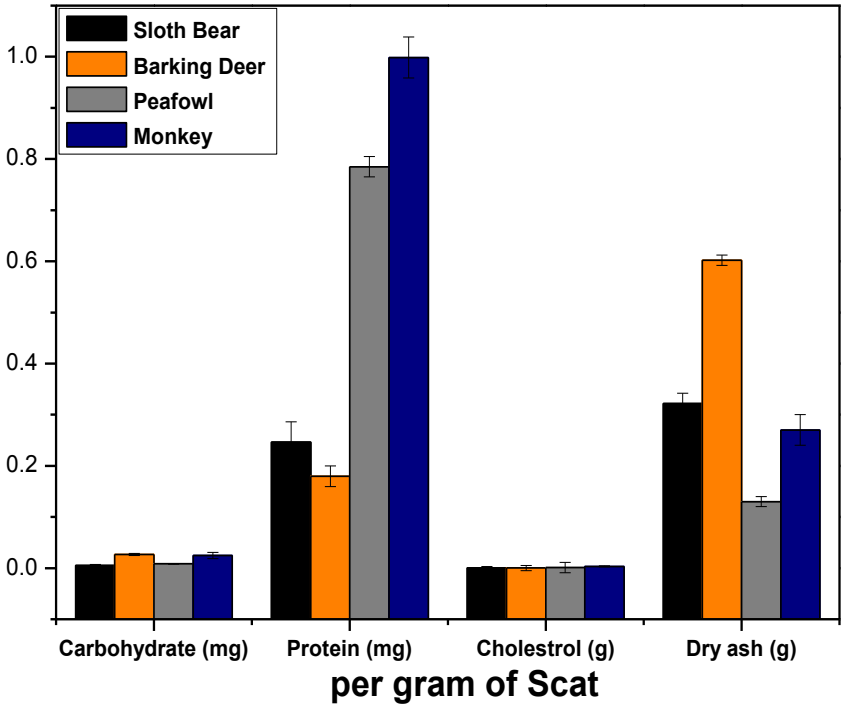


Fig.4.35 Statistical analysis of dietary composition during winter season

d) Spring season

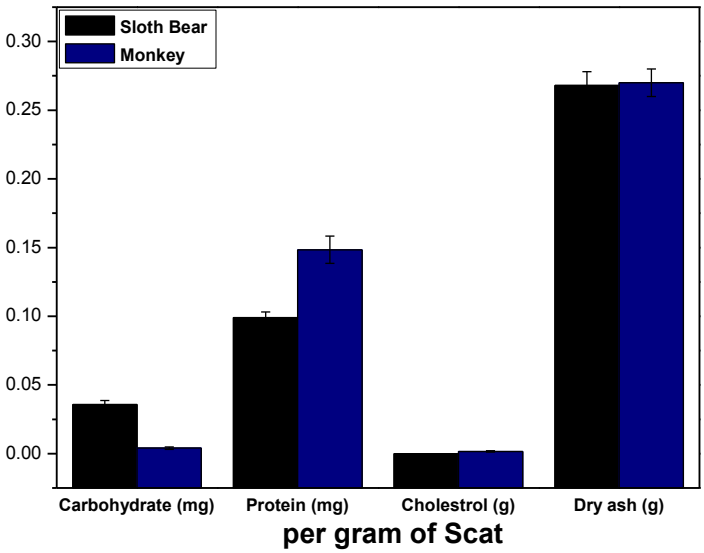
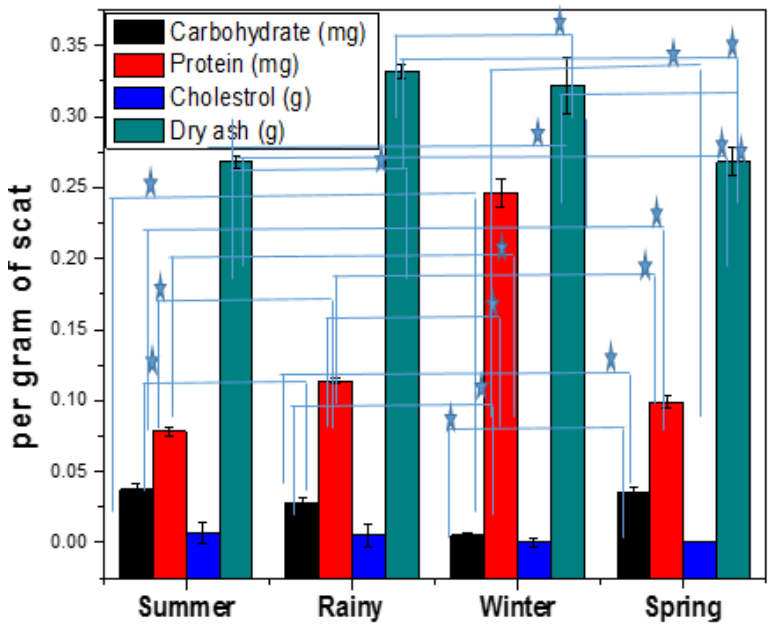


Fig.4.36 Statistical analysis of dietary composition during spring season

4.4 Sloth bear

Sloth bear is protected under schedule I of IWPA 1972 and has been listed as "vulnerable" according to IUCN. So analysis of its scat sample was done in order to understand the feeding management and suggest mitigation measures.

Sloth bear scat was obtained in all the seasons ,thus ,a seasonal study was carried out in order to study the compositional variation in it's scat. Anova was carried out inorder to check the statistical significance.



★ marks for the statistical significance.

Fig.4.37 Statistical significance of dietary composition of Sloth bear

4.5 MITIGATION MEASURES:

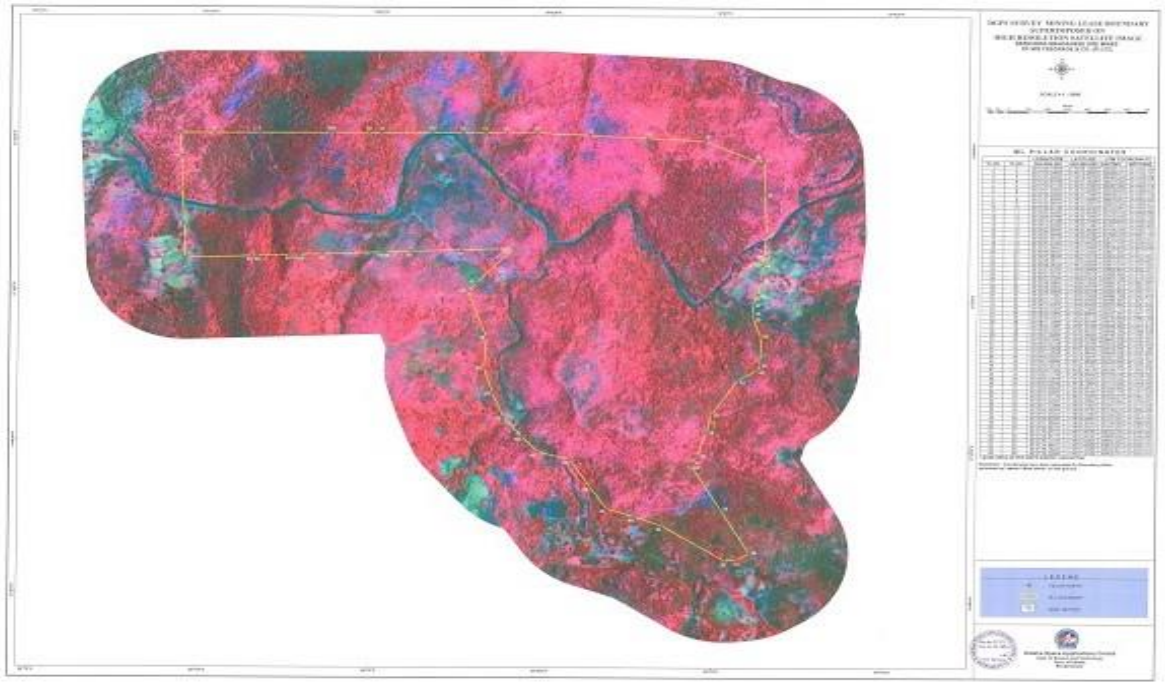


Fig.4.38 Map of the study area

The purposed mining site of Sarkunda Iron and Manganese Mines divided into as Buffer zone and Core zone on the basis of mining impact on it .According to the geological distribution, The total lease area covers a total area of 972.50 acres or 393.50hec of which 390 hectare comes under the forest land of sarkunda mineswhich is consider as Core Zone and according to geographical location 10 k.m radius surrounding the Core Zone is considerd as Buffer Zone.

During the study,it was found that the high number of of faunal species such as jackal, sloth bear, Hyna, Barking Deer, Wild Boar, Porcupine, Elephant and various types of reptiles and avian species were recorded Both in in the core and buffer zone but evidences were found mostly in the peripheralareas of the mining site.The scats of sloth bear found within the purposed mining site points showed that they feeds on fruits of *Lantana camera (Putus), gular (Ficus racemosa),Madhuca indica (Mahua), peepal(F.religiosa),ber (ziziphus mauritiana),bel (Aegle marmelos),mahua (Madhuka indica) ,(Bela), Diospyrus melanoxylon(Kendu)*which are seasonal fruits. Sloth bear also feeds on termites (Odontotermes obesus) and ant's largely.Bear signs were mostly found in the core region due the water availability, sal mixed forest and mixed forest .Termite mounds dugs by bear were mostly near water. During the winters and monsoon, bears are attracted to crop fields for corn, ground nut, ber which results in human-bear conflict.

Elephant encroachment is mainly for food. In most of the forest areas, water is available throughout the year .Elephants find refuge shelter in these forest patches. Elephant migratory route are gradually encroached by construction resulting in invention of new route for the elephant causing extensive damages. Elephant are migrated mostly during August to September. The encroachment of elephants into human residential area is due to cultivation of crops like Paddy, Sugarcane, Banana .It is a scheduled I species and is listed in the wild life conservation list, therefore proper mitigation measures are needed to be done to ensure that the animals are least affected by the activities of the mining project. Some of the Mitigatory measures that can be adapted to conserve the sloth bear, Elephant and other wild animals present within the purposed mining site are suggested below.

a) **Conservation of habitat-** As from the study and the evidence for sloth bear and other mammals it wasfound that these animalsare seasonal and are distributed along the peripheral area of the site, closed to the reserved forest. They mainly encroach to nearby mining site in search of food only during the fruiting season. Therefore, re-vegetation of the peripheral zone by planting of trees and plants that can serve as food for them, the encroachment of these animals can be prevented. Plantation of *Lantana camera,Diospyrus melanoxylon, Madhuca indica, Phoenix sylvestris,*

Ziziphus numalaria, Holarrhena pubescens, Dendrocalamus calostachyus. and *Eucalyptus* around the peripheral zone can prevent the animals from crossing into the human habitat site.

b) Fencing of mining area- The mining site should be proper fenced to prevent any crossing-over of both domestic and wild animals into the mining site**.** Proper demarcation of the mining area should be made with solar fencing all around the mining area.

c) Nesting: Mitigatory measures for the birds and other small reptiles can be adapted and building of nest for birds in the electric posts and nearby bushes should be taken up. Nesting boxes can be installed in higher trees like *Eucalyptus* and*Tectona grandis*for nesting of birds and squirrels.

d) General awareness- General awareness programs should be conducted to create awareness among the local and tribal on wild life and its conservation.

Site Specific Activities: These activities are necessarily stipulated and shall be implemented in or around the mining site for the immediate vicinity of the leased forest areas. They are as follows.

a) **Safety Zone Plantation:** Maintenance of a safety zone of 7.5 mts all along the outer border of the leased area is needed to be afforested with strip plantation. This strip plantation apart from serving as safety zone also absorbs dust and other pollution of the mining activity and serves as a green belt.

b) **Fencing:** The mining lease areas are to be properly fenced so as to demarcate the area properly as well as to prevent any possible encroachment. It also serves as a barrier preventing the wild animals from accidentally straying into mining areas.

c) **Nesting:** Mitigatory measures for the birds and other small reptiles can be adapted and building of nest for birds in the electric posts and nearby bushes should be taken up.

d) **Reclamation:** The mining waste dumps and pits if left untreated would become potential threat to the ecosystems. The loose soil dumps are need to be stabilized to prevent further erosion and consequential silting up of reservoirs, tanks, rivers etc.

e) **Soil and Moisture Conservation:** The forest land once broken up for the mining projects, it becomes prone to severe soil erosion. The entire landscape gets affected and the damages caused

will be quite serious in nature. The erosion of soil and water will eventually result in the degradation of the forest area surrounding the leased area also. Hence, immediate steps are to be taken up for soil and moisture conservation by way of check dams, gulley checks, retaining walls, culverts, drainages, contour trenching, afforestation, etc.

f) **Medicinal Plantation:** The corridors between the dumping sites are to be utilized effectively and economically. Also, in order to not to obstruct the wind velocity, only dwarf plants need to be planted. These dwarf medicinal plants will be able to withstand the high wind which is usually prevailing in such hill tops caused by the deposition of huge amount of ores.

5

CONCLUSIONS

A survey of the mining area to study the fauna diversity was conducted for consecutive four seasons. The data were then documented. It was observed that Signs of species like Sloth Bear, elephants ,hyena , leopard, wild boar were found in the study area .These animals are protected under schedules of IWPA 1972 and belongs to IUCN red list of threatened species under wildlife program. During the study, indirect sign such as scat was recorded and collected. Scats were then analysed visually in order identify the animal species and their feeding habit. Sloth bear was found to mainly feed on termites, ants, Lantana camara,Ziziphus mauritiana.

Several samples of different species were analysed over all the 4 season, it was found that there was not much variation in carbohydrate excretion throughout the year .It was observed to be less than 0.1mg. Sloth bear feeds on mixed diet in fall inorder to meet the protein demands where as it feeds maily on high carbohydrate fruits .Elephants feeding on barks,leaves,fruits have low mineral contetnt in their diet which leads to their sodium drive resulting in less dry ash content as compared to other large animals. Birds feed on low quality food that are rich in carbohydrate and low in lipid content and include insects in their diet to meet protein demand. Barking deers browse and feeds on yound and tender plants so they have higher carbohydrate content in their scat as compared to other species in that particular season. All the animals seem to excrete proteins in a higher range as compared to other components throughout the year.Monkey's protein concentration in scat seem to escalate in winter season as compared to other seasons due to high intake of insects. Cholesterol change is not significant throughout the year. So, based on their feeding habits and dietary composition, mitigation measures are suggested in order to safeguard the existence of the vulnerable or threatened animal species.

6

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